



# THE VETERINARY BULLETIN

1931

---

VOLUME I

---

WEYBRIDGE:  
IMPERIAL BUREAU OF ANIMAL HEALTH  
WEYBRIDGE, SURREY  
ENGLAND



Digitized by the Internet Archive  
in 2025

# Imperial Agricultural Bureaux.

---

## EXECUTIVE COUNCIL.

---

<i>Member :</i>	<i>Representing :</i>
Mr. F. L. McDOUGALL, C.M.G., ( <i>Chairman</i> ) ... ..	Australia.
Sir CHARLES HOWELL THOMAS, K.C.B., C.M.G. ( <i>Vice-Chairman</i> ) ... ..	England and Wales.
Sir ROBERT GREIG, M.C., LL.D. ... ..	Scotland.
Dr. G. SCOTT ROBERTSON, D.Sc. ... ..	Northern Ireland.
Dr. J. H. GRISDALE ... ..	Canada.
Mr. G. W. KLERCK ... ..	South Africa.
Mr. NEVILL L. WRIGHT ... ..	New Zealand.
Dr. J. H. HINCHCLIFF, Ph.D. ... ..	Irish Free State.
Dr. R. P. PARANJPYE, M.A., D.Sc. ... ..	India.
Mr. B. F. WRIGHT ... ..	Southern Rhodesia.
Mr. R. V. VERNON, C.B. ... ..	Colonies, Protectorates and Man- dated Territories.

Sir DAVID CHADWICK, C.S.I., C.I.E. (*Secretary*),  
2, Queen Anne's Gate Buildings,  
Dartmouth Street, London, S.W.1.

---

## STAFF OF IMPERIAL BUREAU OF ANIMAL HEALTH, WEYBRIDGE.

---

### *Director :*

W. HORNER ANDREWS, D.Sc., M.R.C.V.S.

*Deputy Director and  
Editor of The Veterinary Bulletin :*

W. A. POOL, M.R.C.V.S.

### *Second Officer :*

HENRY P. FOX, D.V.Sc., D.Ag.Sc. (Kharkov), M.R.C.V.S.

### *Third Officer:*

J. T. EDWARDS, M.R.C.V.S.



IMPERIAL BUREAU OF ANIMAL HEALTH.

# THE VETERINARY BULLETIN

Vol. 1.]

April, 1931.

[No. 1.

## DISEASES CAUSED BY BACTERIA AND FUNGI.

PLASTRIDGE, Wayne N., and MCALPINE, James G. (1930.) **Microbic Dissociation in the *Abortus-melitensis* Group. Observations on the Mucoid Form.** *Jl. Infect. Dis.* **46.** 315-323.

The authors attempted to restore the property of sugar utilisation to strains of the *abortus-melitensis* group which had lost it. They found that prolonged growth in liver infusion broth gave rise to a variant which they speak of as the "mucoid" form but make no attempt to classify it as an "S" or "R" type because of certain discrepancies.

This "mucoid" form was a capsulated, cluster-forming organism with a tendency to spontaneous agglutination. Biochemically, it was more active than the normal type, utilising more sugar and acting more characteristically on dyes. Serologically, it was less active than the normal type.

HABS, H. (1930.) Ueber die Einwirkung von Melitensis-und Abortusbakterien auf Farbstoffe. [On the Effect produced by *Br. melitensis* and *Br. abortus* on Dyes.] *Zlb. f. Bakt. (Orig.)*. **116.** 89-92.

The author found that, out of thirty-one dyes used in the experiments, reduction occurred only with thionin, methylene-blue, toluidin blue and cresol blue. There was no difference in the action of the two organisms on the dyes.

HASLEY, D. E. (1930.) *Brucella abortus* in Certified Milk. *Jl. Infect. Dis.* **46.** 430-434.

An account of an investigation of the value of plate cultures for the detection of *Br. abortus* and for estimating the numbers of the organism in milk. Certified raw milk distributed in Detroit was used, and the samples were thirty to forty-eight hours old when they were dealt with. The portions used in the test were taken from the mixed milk, and were plated on to Stafseth's liver agar containing 1 in 200,000 of gentian violet, the plates being incubated in an atmosphere containing 5 per cent. carbon dioxide.

*Br. abortus* was isolated from 10 out of 230 samples taken from five dairies. An average of two organisms per c.c. was present in the infected samples, and the largest number in any sample was eight per c.c.



HUDDLESON, I. Forest. (1930.) **I. The Significance of Brucella Agglutinins in the Blood of Veterinarians.** *Jl. Amer. Med. Ass.* 94. 1905-1907.

This is a paper from the CENTRAL BRUCELLA STATION, Department of Bacteriology, Michigan State College, U.S.A., of which HUDDLESON is Director. If *Br. abortus* is highly pathogenic for man, the disease should be common in veterinarians who come into close contact with infected animals. If bovine strains are as infective to man as swine strains and as *Br. melitensis*, veterinarians would be expected to show as high a percentage of infection as is seen in those who have become infected in laboratories from working with the latter organisms.

Using his rapid agglutination technique, the author tested the blood of 49 veterinarians who attended a conference. Agglutinins were present in 57 per cent. of the serums, and they were present in a titre of 1 : 100 or higher in 26 per cent. Only three of those whose serum yielded positive reactions had a history of past or present clinical manifestations of undulant fever.

The serum of two veterinary students gave positive reactions, one after attending to infected cows during a vacation, and the other after helping to carry out agglutination tests in the author's laboratory. The reaction of the former was 1 : 500, a month or two after the exposure, and less than three months later it had become much weaker. He never suffered from any sign of undulant fever. The other student developed slight tonsilitis and a cold soon after the potential exposure, but there was no evidence that the illness was associated with the reaction, and it was at this stage that his blood was tested. A fortnight later the reaction had become weaker.

The author argues that the presence of the agglutinins in the blood of the two students is fairly certain evidence that they had been in contact with infective material. Their failure to develop the disease may have been due to either of two factors operating separately or together, namely, low pathogenicity for human beings of the strains in the infective materials, or native resistance of the two individuals to *Brucella*. Taking the results in the veterinarians into account, the author argues that both factors operated in the case of the students, and that this provides an explanation of the incidence of *Br. abortus* infections and reactions in human beings : or in other words that the organism has invasive properties for human beings as is evidenced by the presence of specific agglutinins in the blood of those who come in direct contact with a large amount of infective material ; but that it has low pathogenicity for human beings, as is evidenced by the small number who develop the disease after direct contact. Even in the case of natural *Br. melitensis* infection, only a relatively small percentage of the exposed human beings contract undulant fever.

CUTANEOUS HYPERSENSITIVENESS TOWARDS *Brucella*. Veterinarians commonly note that a peculiar erythema develops on the skin of their arms following contact with the vaginas of certain cows, particularly those which have aborted. Out of 50 veterinarians questioned, ten suffered from this condition, and they were working on animals infected with *Br. abortus*.

The erythema makes its appearance usually on the lateral surface of the forearm, about twenty minutes after exposure. Two types of reaction occur. In one type, light red, irregular blotches appear on the skin, or the entire surface of the forearm may become a light red. When viewed closely these blotches appear as minute, slightly separated reddish points and, from a distance, they have the appearance of an erythema. The points are not elevated ; the skin becomes pale on firm pressure, and there is an intense itching or burning sensation. The discoloration disappears in four to eight hours, and there is no exudation or desquamation.

In the other type, the rash appears as small discrete, elevated reddish papules which are more widely separated than in the first type. The papules often persist for three to four days, and there is no exudation or desquamation.

The author carried out intradermal tests with a porcine strain on three of the hypersensitive subjects whose blood serum was positive to the agglutination test. Local and constitutional reactions occurred, and these are described, as are also positive intradermal reactions in subjects who were not hypersensitive. The author suggests that the skin symptom developed in individuals who have become hypersensitive should be called *erythema brucellum*.



SUNDBERG, Ragnar. (1931.) Komplementbindningsvärdena efter två subkutana vaccinationer på nötkreatur med abortvaccin, utförda i följd med resp. tre, fyra och fem dagars mellantid mellan vaccinationerna. (Complement-Fixation Values after two Successive Subcutaneous Treatments of Cattle with *Abortus Bacterin* carried out at Intervals of three, four and five Days between the Respective Treatments.) *Skand. Veter. Tidsk.* 21. 60-66.

Four groups of five cattle were inoculated at intervals of three, four and five days respectively, with *Br. abortus* vaccine killed by heat, group 1 being treated once, and groups 2, 3 and 4 twice each.

The complement-fixation and agglutination tests were carried out with the blood serum of each animal just before vaccination and were repeated once a fortnight for four months: two complete sets of results of these tests, one obtained with heated serum, and the other with unheated serum, are given in tabular form.

When vaccination was repeated at three or four-day intervals, there was a marked rise in the titres of the serological reactions, but vaccination at five-day intervals produced about the same result as a single vaccination, and the high titre reactions were maintained for longer periods than the low titre ones.

The author discusses the theories which may be held to explain these results.

BOAK, R. A., and CARPENTER, C. M. (1930.) *Brucella abortus* Agglutinins in Porcine Blood. *Jl. Inf. Dis.* 46. 425-429.

There is very little information as to the extent to which swine in the United States are infected with *Br. abortus*. CONNAWAY, DURANT and NEWMAN (1921) obtained positive agglutination reactions in 26 out of 30 herds examined. HADLEY and BEACH (1922) reported that 24 per cent. of 188 swine breeders in Wisconsin had observed abortions in their herds. HARDY (1929) obtained 2.9 per cent. of positive agglutination reactions in 243 porcine blood samples.

The authors examined 4,014 blood samples from pigs slaughtered at abattoirs in New York State. Positive reactions were obtained in 1.54 per cent. of the samples. Three of the positive samples were from pigs from Ohio. Samples from 16 out of 846 pigs from Illinois, 28 out of 1,230 from Indiana, 8 out of 485 from Missouri, and 7 out of 770 from Nebraska gave positive reactions.

The authors infer that swine infection is rare in New York State, and not uncommon in the Middle West.

GWATKIN, R. (1931.) The Rapid Macroscopic Agglutination Test for Bang's Disease. *Jl. Am. Vet. Med. Ass.* 78. 88-91.

Refers to his earlier (1922) description of a rapid macroscopic agglutination test, to Huddleson's (1926) technique, and to the authors who have reported on the results obtained with Huddleson's method. GWATKIN considers that more factors require control when carrying out the rapid method than with the regular test and that, in consequence, the former method is less reliable.

"Accepting the regular test as the standard, the rapid method showed no reaction with ten positive sera, and gave a positive reaction with six negative samples, a difference of 16 in 284 (5.6 per cent.). Including variations as between suspicious and positive and suspicious and negative, 29 samples differed from the regular test (10.2 per cent.).

"In addition to these, one hundred samples were tested without the application of heat, and fifteen positives failed to show any reaction by the rapid method (15 per cent.). Heat, agitation of the mixture, and the area over which the fluid is spread, appear to be the factors that influence the amount of reaction manifested by the serum-antigen mixtures."

GRAHAM, Robert, and THORP, Frank. (1930.) *Brucella* Agglutinins in the Blood and Milk of Cows. *Jl. Inf. Dis.* 46. 260-262.

Gives the correlation of specific agglutinins for *Brucella* species in the blood and milk of certain cows examined.

Disagreements which occurred between the blood and milk agglutination reactions in the same animals consisted largely of negative reactions obtained with milk serum when the blood reactions were positive.



EDGINGTON, B. H., and BROERMAN, Alvin. (1930.) **The Double Intradermal Test for the Diagnosis of Infectious Abortion in Cattle.** *Jl. Amer. Vet. Med. Ass.* **76.** 191-210.

The authors prepared the suspension for agglutination tests from six bovine strains of *Br. abortus*, and the antigen for the intradermal tests from a strain isolated from the stomach of an aborted calf. In reading agglutination tests a titre of 1 : 80 or higher was regarded as positive. The extract for intradermal testing was prepared by incubating the cultures for 48 hours at 37° C., placing them in the dark at room temperature for 48 hours, followed by twelve days in a refrigerator at 33-40° F. A saline suspension was then made to a standard of 5.5 mm. by the Gates' method, and heated at 65° C. for 30 minutes in a water bath.

With the standards adopted by the authors there were more positive reactions to the intradermal test than to the agglutination test. No animal that was positive to the intradermal test and negative to the agglutination test had a history of *abortus* infection. Of six animals that gave positive agglutination and negative intradermal reactions, there was a history of *abortus* infection in four.

The results of single intradermal injections were considered to be as satisfactory as those yielded by double injections.

TORREY, J. P., and HALLMAN, E. T. (1930.) **The Pathogenicity of Abortion Vaccines for Guinea-pigs.** *Jl. Am. Vet. Med. Ass.* **76.** 7-16. With four figs.

On account of the importance attached to the danger of using virulent organisms in "live vaccines," the authors tested certain commercial abortion vaccines on guinea-pigs. They selected the vaccines sold by 9 out of rather more than 20 firms licensed by the Bureau of Animal Industry, U.S.A.

They inoculated eight guinea-pigs in pairs with 0.25, 0.5, 1.0 and 2.0 c.c. of each vaccine respectively, giving it subcutaneously and intraperitoneally to one of each pair.

At the same time they plated out 0.1 c.c. amounts of each vaccine on plain liver agar, carbolfuchsin liver agar and thionin liver agar, incubated the plates for five days at 37° C., then placed them in an atmosphere of 10 per cent. carbon dioxide, and incubated them for three days. All the cultures reached their maximum growth aerobically. Sub-cultures were made on agar slopes, and agglutinability was tested with a known positive serum.

The guinea-pigs were weighed and killed eight weeks after inoculation; blood was collected for testing, the lesions were examined macroscopically and microscopically, and inoculations on to culture media were made from visceral organs.

Live bacilli appeared to be absent from two of the vaccines. Cultural tests were negative, while guinea-pig inoculation was mildly positive with one vaccine; only a few colonies appeared in the plates from the original material of one vaccine, while the guinea-pig inoculations yielded some positive results, but no evidence of great virulence. Three of the vaccines contained bacilli of high virulence, and the bacilli in the remaining two vaccines were of attenuated virulence.

The authors noted that the number of organisms per dose recommended by the manufacturers varied from 200 billion, in the most highly attenuated vaccines, to 1,200 billion of one of the most virulent vaccines.

BIRCH, R. R. (1930.) **Bang Abortion Disease in Relation to Interherd Transfer of Cattle.** *Cornell Vet.* **20.** 123-135.

The author discusses in general terms the eradication of *Br. abortus* infection from herds and the manner in which "clean" herds can be kept up to the desired size. He deals with the practical side of the question, taking into account the available scientific data, and considers the nature of official regulations required for the control of the infection.

JAMES, W. A., and GRAHAM, Robert. (1930.) **Porcine Osteomyelitis, Pyemic Arthritis and Pyemic Bursitis associated with *Brucella suis* Traum.** *Jl. Amer. Vet. Med. Ass.* **77.** 774-782.

Stiffness and lameness had caused trouble in a piggery for about 15 years, and treatment for



rheumatism had been employed without success. At the time of the authors' examination, 25 out of 75 pigs were affected, and among them were pigs of all ages from six weeks to three years old. The fetlocks were most commonly the seat of lesions, but other joints were also involved. About 20 per cent. of the gilts and 10 per cent. of the sows had aborted. There was no abortion in the cattle on the farm, but sterility was not uncommon.

A bacteriological examination was made of two pigs, and *Br. abortus suis* Trautman was isolated from affected joints. Guinea-pig inoculations and serological tests with the organism and the serum of affected pigs supported the claim that it was related to the infection.

BAXTER, James. (1930.) **A Case of Abortus Fever in N. Ireland.** *Brit. Med. J.* May 10th. p. 861.

This case, which is said to be the second one reported in N. Ireland, occurred in a farm labourer whose occupation brought him into association with cattle.

At the third week of illness Widal reactions were negative to *B. typhosus* and *B. paratyphosus* A and B on two occasions. The patient's serum was then put up against *B. typhosus* (O), *B. paratyphosus* C and *Br. abortus*, and agglutination occurred with *Br. abortus* up to 1 in 250.

Various attempts were made to isolate the organism. A blood culture incubated at a lowered oxygen tension for eight days remained sterile. Culture media inoculated with samples of bile obtained by a duodenal tube and with catheter specimens of urine, failed to yield a growth of *Br. abortus*.

The author considers that the occurrence of febrile illness somewhat resembling an enteric infection, but with no agglutination of the paratyphoid—typhoid organisms by the patient's serum, together with agglutination of *Br. abortus* by his serum, and his occupation, prove that the illness was due to *abortus* fever.

BROADBENT, W. (1931.) **Undulant Fever Acquired from a Goat in England.** *Lancet.* January 10th. p. 76.

A boy, 3½ years old, became ill soon after the introduction of goats to the farm on which he lived. He had not drunk any goats' milk. The cause of illness was not recognised at first; at about the seventh week of illness an agglutination test of the patient's serum gave a negative reaction to *Br. abortus*, but four days later the report on a blood culture was:—"Growth of very small gram negative organisms arranged as paired cocci or short chains of three or four. Short bacillary forms also present. *Brucella melitensis*." The Ministry of Health then examined the goats and found that the blood of one of them agglutinated *Br. abortus* in a dilution of 1 in 25, and that this goat had aborted twice. The author considers that it is evident that the child was infected by bacilli excreted by the goat.

CRUICKSHANK, J. Norman, and CRUICKSHANK, Robert. (1930.) **Abortus Fever: Notes on a Case Occurring in Scotland.** *Brit. Med. J.* February 1st. p. 195.

This is a record of the first case of human *Br. abortus* infection in Scotland. The patient was a dairy farmer and, one to two months after the onset of illness, his serum yielded negative Widal tests for typhoid and paratyphoid, but was positive to *Br. abortus* and *Br. melitensis* at 1 in 2,560.

A suspension of *Br. abortus* completely removed the agglutinins for the homologous organism, but did not remove all those for *Br. melitensis*. Conversely, a suspension of three serological strains of *Br. melitensis* removed all agglutinins for *Br. melitensis* and *Br. abortus*. Blood cultures taken on three occasions between about the fifth to the tenth weeks of illness yielded negative results, as did attempts to isolate *Br. abortus* from the urine and faeces. Guinea-pigs inoculated with the patient's blood and with urine failed to develop agglutinins in their blood, and were healthy when destroyed and examined six weeks later.

A diagnosis of *abortus* fever was made on the following grounds:—(1) the presence of an undulant fever; (2) the presence of a high agglutinin titre for *Br. abortus*, and the absence of a positive Widal reaction for the typhoid-paratyphoid group; (3) the absence of clinical, bacteriological and serological evidence of any other infection likely to cause an undulant fever and (4) the patient's close association with cattle.



MACARTHUR, W. P., and WIGMORE, J. B. A. (1930.) **Undulant Fever Due to *Brucella abortus*. Isolation of the Organism from the Urine.** *Brit. Med. J.* May 10th. pp. 858-859.

The authors record a new case and say that, up to the time of writing, 17 cases of human infection with *Br. abortus* had been reported in England, and that the causal organism had been recovered from only one of the cases, diagnosis in the remainder being based on the results of agglutination tests.

The patient whose illness is now described had not been out of England for ten years. Agglutination tests carried out in the course of the illness were negative for the typhoid group, but positive to *Br. abortus*. Blood cultures taken about a month after the onset of illness gave negative results. Catheter specimens of urine taken about the sixth month of illness yielded an organism with the characters of *Br. abortus*. It was agglutinated by serums prepared by the inoculation of rabbits with living cultures of three undoubted strains of *Br. abortus*. It was not, however, agglutinated either by the standard agglutinating serum prepared by the "Standards Laboratory," Oxford, nor by serums prepared from two undoubted strains of *Br. melitensis*, but the authors considered that it was significant that there was a positive reaction with an anti *para-melitensis* serum at 1 in 500.

A serum, prepared by immunising rabbits with live cultures of the strain isolated by the authors, agglutinated 13 different strains of *Brucella*, the highest end-point (1 in 1,250) being given by a swine strain of *abortus*.

The patient's blood serum agglutinated 22 different strains of the *Brucella* group, giving titres up to 1 in 250 with *melitensis* and *paramelitensis* strains, and up to 1 in 2,500 with the swine strain of *abortus*. Using the standard agglutinable cultures of Oxford and of the Royal Army Medical College, the *Br. abortus* cultures agglutinated up to titre, but the *Br. melitensis* cultures did not agglutinate up to more than half the full titre.

In view of the results obtained in the agglutination tests, and the fact that the new strain grew readily in ordinary media, and in the absence of a special atmosphere of CO<sub>2</sub>, the authors consider that the organism probably belongs to the swine variety of *Br. abortus*.

SCOTT, W. S. (1930.) **A Case of Undulant Fever.** *Brit. Med. J.* May 10th. pp. 861-862.

At about the third week of illness, agglutination tests gave a reaction of 1 : 250 to *B. typhosus* and negative reactions to *B. paratyphosus A* and *B.* At this time, the medical attendant found that the author kept a herd of Jersey cattle in which there was *Br. abortus* infection, and that milk from a heifer which had aborted recently had been used in the house. The positive Widal reaction was considered to be the result of repeated war-time T.A.B. inoculations. Further tests then carried out gave positive agglutination reactions to *B. typhosus* at 1 : 300, to *Br. abortus* at 1 : 200, and to *Br. melitensis* at 1 : 200. No attempts were made to isolate the organism.

WISHART, W. H., and GIBSON, H. J. (1930.) **Note on a further Case of Undulant (*Br. abortus*) Fever occurring in Scotland.** *Brit. Med. J.* May 10th. pp. 860-861.

The patient was a technical chemist, residing in Edinburgh. His serum was tested four weeks after the supposed onset of illness, and gave negative reactions for typhoid and paratyphoid. It agglutinated four strains of *abortus* at 1 : 1,600, 1 : 3,200, 1 : 3,200, and 1 : 6,400, and 3 strains of *melitensis*—at 1 : 800, at 1 : 1,600, and 1 : 3,200 respectively.

Absorption of the serum with *Br. abortus* removed agglutinins for all strains of *abortus* and *melitensis*. Absorption by three *Br. melitensis* strains only removed agglutinins for these strains, the same high agglutination titres for *Br. abortus* being noted after absorption as before.

Cultural tests with blood and urine gave negative results at about the fourth week of illness. A guinea-pig inoculated with urine, and killed 21 days later, yielded negative results both as to lesions and cultures from the tissues. Its serum, however, gave a positive agglutination reaction at 1 : 80 with a strain of *Br. abortus* (hog), and at 1 : 20 to 1 : 40 with the *Br. melitensis* strains. The authors assume that normal serum effects were probably responsible for these reactions.

WILLIAMS, E. Roland, and SLADDEN, A. F. (1930.) **A Case of *Br. abortus* Infection.** *Brit. Med. J.* May 10th. pp. 859-860.

It has been suggested that there is a real extension of human *Br. abortus* infection in most countries, coincident with more frequent and widespread epizootics among cattle. [Proof of this theory has, of course, not yet been produced.] The authors report a case which occurred in a farmer in Wales. On the tenth day of illness the serum was negative to agglutination tests for typhoid and paratyphoid. A reaction of 1 : 2,500 was obtained with *Br. abortus* (Oxford suspension), and of 1 : 2,500 with a strain of *Br. melitensis*. From the fact that the patient had manually inserted a pessary into the vagina of a cow which had aborted on his farm, and that the disease was prevalent in the neighbourhood, the authors assume that infection probably occurred, directly or indirectly, from his hands as a result of this operation.

DARSIN, E. (1930.) Zur Serodiagnose des Bangschen Abortbacteriums beim Menschen nach Untersuchungen in Lettland. [The Sero-Diagnosis of Bang Abortion Bacteria in Human Beings, according to the Investigations carried out in Latvia.] *Zlb. f. Bakt. (Orig.)* 115. 457-464.

A positive agglutination reaction was obtained at dilutions of 1 : 100 and 1 : 200 in 18 out of 1,100 samples (1·6 per cent.) of human serum from Latvia. The author gives details of a strain of *B. proteus* he isolated from a purulent lesion in a human patient; it was agglutinated by *Br. abortus* sera.

LANG, H. J. (1930.) Bang-Infektion mit Vaccine behandelt. [*Br. abortus* Infection in Man treated by means of Vaccination.] *Medizin. Klinik.* 26. 389.

In this case a man became infected after drinking large quantities of raw milk. Diagnosis was positive to the agglutination test with a titre of 1 : 3,200. Treatment was carried out by a vaccine prepared from *Br. abortus*.

LUSTIG, A. (1930.) Ueber die zwischen dem Erreger des Undulansfiebers (Maltafieber) und dem des Abortus epizooticus bovinus (Bac. Bang.) bestehenden Analogien. [On the Analogies between the Causal Agents of Undulant Fever and Bovine Contagious Abortion.] *Zlb. f. Bakt. (Orig.)* 115. 219-22.

This is purely a compilation in which the author gives an up-to-date survey of the recent research work carried out by BASTAI, CERRUTI, VERCELLANA, ZANZUCCHI, FAVILLI and BONCINELLI at the Institute of General Pathology and Bacteriology of the University of Florence.

MAGENDANTZ, H. (1930.) Zur Kenntnis der Banginfektion beim Menschen. [*Brucella abortus* Infection in Man.] *Medizin Klinik.* 26. 236-237.

This is a case record of a 42-year-old groom who became infected with *Br. abortus* after assisting at the parturition of some cows affected with contagious abortion. He had not acted as a milker, and had drunk very little milk.

Diagnosis was based on the agglutination test, with which a positive titre of 1 : 3,200 was obtained with a *Br. abortus* antigen.

CARPENTER, C. M., and BOAK, R. A. (1930.) **Undulant Fever. Laboratory Diagnosis.** *Jl. Lab. & Clin. Med.* 15. 437-443.

This article summarises the methods available for the laboratory diagnosis of undulant fever, including the differentiation of *Br. melitensis* and *Br. abortus*.



[REPRINTED, WITH PERMISSION, FROM THE "BULLETIN OF HYGIENE." 6. 1-5]

GLOYNE, S. Roodhouse. (1931.) **BCG Vaccine—A Review of its Uses.**

The first paper on *Bacillus Calmette Guerin* or BCG vaccine was published by CALMETTE and his colleagues<sup>1</sup> in 1926, and was abstracted in the first volume of the *Bulletin of Hygiene*<sup>2</sup>. In 1928 CALMETTE brought his publications up to date in book form<sup>3</sup>, and in the same year he added a long chapter on the subject to the third edition of his well-known book on "*L'Infection Bacillaire et la Tuberculose*."<sup>4</sup> Since then the output of work on this subject has been enormous. Reference to the admirable Quarterly Cumulative Index Medicus,<sup>5</sup> published by the American Medical Association, gives well over 300 references from January, 1928, to June, 1930. It is obviously quite impossible, therefore, to do more than summarize a few of the more important. Briefly stated, BCG vaccine is prepared from living culture of a strain of *Myco. tuberculosis* (Bovine), known as "lait de Nocard," which, previous to its use for vaccine purposes, had been grown on a special bile medium in no less than 230 subcultures over a period of 13 years, until it was believed to have lost its natural virulence for mammals and birds. After a preliminary test of this vaccine on animals, CALMETTE and his co-workers gave the vaccine by mouth to 1,317 new-born infants, 586 of whom came from a tuberculous environment. The mortality from tuberculosis in this latter group CALMETTE found to be 1·8 per cent., as compared with 25 per cent. of deaths of unvaccinated infants from a tuberculous environment. He therefore considered that BCG had protected 93 per cent. of the vaccinated infants, and that without this vaccination they would have succumbed to tuberculosis in the first year of life. For this special form of vaccination CALMETTE has introduced the word "Premunition." In a subsequent paper,<sup>6</sup> he recorded the results in 3,808 infants from a tuberculous environment, vaccinated less than a year at the time of the report. The mortality from tuberculosis in these infants was calculated as 0·9 per cent., as compared with 24 per cent. amongst infants living under the same conditions but not vaccinated. M. GREENWOOD<sup>7</sup> subsequently pointed out various statistical errors in the calculations employed by CALMETTE, notably that the tuberculosis mortality in vaccinated children was calculated on a variable period of less than a year, whilst the mortality of unvaccinated infants born in a tuberculous environment used as a comparison was in some instances wrongly estimated.

In his address to the International Union against Tuberculosis held at Oslo in August, 1930, CALMETTE<sup>8</sup> gave his latest figures. In France from July 1st, 1924, to June 1st, 1930, more than 210,000 children had been vaccinated with BCG. The figure for tuberculosis mortality for the age-group one month to four years in France was 15·9 per cent., whereas the corresponding figure for these vaccinated children was 3·4 per cent. Comparing the results of unvaccinated and vaccinated infants in a tuberculous environment, CALMETTE gave the mortality for unvaccinated as 18 per cent., and for vaccinated as 2·4 per cent.

Referring to various objections made to his system of "premunition," CALMETTE stated that the literature now contained records of nearly 200 autopsies upon these vaccinated children, and in no case had tuberculous lesions been found containing virulent tubercle bacilli. With regard to the criticism raised that the BCG was not entirely harmless, CALMETTE cited a large number of experiments in animals of all kinds made by himself and others to show that the BCG strain did not produce a progressive tuberculosis. As to the criticism made on the other side that BCG had now been subcultured for so many years that it had lost any immunizing properties it may have had, CALMETTE considered that the strain was absolutely stable, whilst the failures to protect had been very few.

Previous to this communication a technical Conference convened by the Health Committee of the League of Nations<sup>9</sup> in October, 1928, had considered the results obtained. The findings of the Conference represent the views of three Commissions of bacteriologists, clinicians and veterinary surgeons. The Bacteriological Commission agreed that the results justified the conclusion that BCG was a harmless vaccine. The Clinical Commission reported that BCG was incapable of producing virulent tuberculous lesions, and that vaccination produced a certain degree of immunity against tuberculosis. (This Commission suggested further research over a longer period, and consultation with a Committee of Expert Statisticians to meet the criticisms of those who found the existing

figures difficult to interpret). The Veterinary Commission found that vaccination in bovines was a perfectly harmless procedure, and conferred definite immunity.

It will be seen that the three Commissions of the League varied in their emphasis. The Bacteriological Commission referred to BCG as a harmless vaccine, the Clinical Commission considered it produced a certain degree of immunity, and the Veterinary Commission that it conferred definite immunity. CALMETTE's latest figures given to the Oslo Conference in August last, and the discussion which followed also indicate that the risks of giving the vaccine to infants have so far been found to be very small. (The Lubeck tragedy,<sup>10</sup> in which a number of infants died after vaccination, was traced to contamination, and cannot be attributed to the BCG strain).

Working on behalf of the Kiev Commission, NECHTADIMENKO, ODRINO, SYSSAK, and AUGUENITSKI<sup>11</sup> vaccinated, during the period from 1926 to April, 1930, 155 infants of which 87 lived in tuberculous households and under very poor sanitary conditions, and the remainder under comparatively good conditions. The infants were carefully watched, and it was found that the physical development was normal in 76 per cent. of those living under poor conditions and in 90 per cent. of the other group. Three of the first group of children contracted benign forms of tuberculosis, and the five deaths which occurred were all in this first group, four from non-tuberculous disease and one only from general tuberculosis. The Commission point out the necessity for keeping the children free from infection, as far as possible, for the first month after vaccination, that is until they have acquired immunity. If tuberculosis occurs it is generally a benign form.

A considerable amount of research has been done on the fate of the bacilli after inoculation into infants. CHAUSSINAND<sup>12</sup> vaccinated a series of infants by intramuscular injections. In his first group he gave eight children one injection, and in the second group nine children two injections. Five of the eight in the first group had cold abscesses and, in one case, the abscess was of considerable size, and necessitated several aspirations. Of the three infants in this first group, who showed no local abscess, one had infiltration of the muscle at the site of inoculation, and another, a case of hydrocephalus with spina bifida, died 34 days after vaccination of bronchopneumonia, and showed at the site of inoculation infiltration of the muscle, but nothing else. It is not stated what investigation was made of the bronchopneumonic lungs at the autopsy to exclude tuberculosis. The third child of this series also showed local infiltration at the site of inoculation. In the second group local abscess only occurred in one case, the other infants showing merely local infiltration of the muscle. One of the infants in this group, however, died of tuberculous meningitis 64 days after vaccination. On enquiry it was found that during the period following vaccination a grandparent with whom the child had been in contact had also died of pulmonary tuberculosis with positive sputum. The author gave no record of bacteriological examinations of post-mortem material in this case, but seemed satisfied that it was a contact and not a vaccination infection, and drew the conclusion that especial care should be taken to keep infants out of infected environments for six to eight weeks after contact with tuberculosis, during which time they are developing an allergy. The only advantage of the intramuscular method appeared to be, in the author's view, the more rapid development of allergy. CHAUSSINAND and TEMPE<sup>13</sup> also injected 2 mgm. of BCG into the peritoneum of a hydrocephalic monster of seven months. There appeared at the site of injection a subcutaneous cold abscess "the size of a nut." The abscess was movable, and did not communicate with the peritoneal cavity. The abscess contained acid fast bacilli which, however, did not infect a guinea-pig. The abscess healed, but four months after inoculation the infant died, and the autopsy revealed some minute lesions containing tubercle bacilli in the liver, spleen and kidney. No sign of tuberculosis elsewhere was discovered, and it was believed that the infant died as the result, either of the hydrocephalus or of enormous doses of vigantol with which it had been treated. A second case is quoted by these authors of an infant (born of a mother seriously ill with tuberculosis) which was treated with 10 mgm. of BCG by mouth daily, from the fourth to the ninth day after birth, thus receiving a total of 60 mgm. BCG. The child subsequently developed whooping cough, then a purulent otitis and dyspepsia, and subsequently bronchopneumonia, but in spite of these setbacks survived, a result which the authors believed indicated that the BCG had had no harmful effect. The third infant, a congenital syphilitic, was given two subcutaneous inoculations totalling 0.025 mgm. A little pus developed at the site of inoculation which, after culture, showed BCG. A subculture of this was inoculated into two other children, subcutaneously, in doses of 0.05 mgm. The children showed small nodules at the site of inoculation, but remained well. The authors suggested from this experiment that further attenuation of BCG had taken place in the syphilitic child.



With regard to the effect of BCG on small laboratory animals the evidence is conflicting. Numerous papers have been published showing that a non-progressive form of tuberculosis only is produced. Thus ZEYLAND,<sup>14</sup> referring to an earlier publication (*Ann. Inst. Pasteur*, 1928, **42**, 652), in which necrotic lesions produced by the inoculation of BCG in experimental animals in situations where massive accumulation of bacilli was favoured, subsequently found that it followed intrapleural and intrarenal inoculation, but not intraperitoneal, where peristaltic movements were apparently inimical. It was believed that the production of necrosis was due to endotoxin and could be obtained with saprophytic acid fast bacilli. With the aid of a surgical colleague the author inoculated quantities of BCG into the kidney of rabbits after exposure and incision of the organ. In eight animals bioscopic examination was made from 20 days to three months afterwards, in order to examine the necrotic nodules which were produced. In the first few days after inoculation necrosis of the renal tissue round the operation wound was noticed. This necrosis enclosed enormous masses of BCG surrounded by polymorphonuclear cells some of which were phagocytizing. Two weeks later these nodules consisted simply of necrotic masses surrounded by typical tuberculous tissue with epithelioid and giant cells and new-formed capillaries with large masses of bacilli. At the end of two months calcified particles were found in the necrotic nodules, and the lesions lost their specific aspect. The epithelioid cells and giant cells disappeared and the necrotic area became surrounded by fibrous tissue. At the end of a year there were still necrotic nodules, but for the most part they were very small; they were surrounded by fibrous tissue, contained calcified particles and very few bacilli. In other cases there were only cicatrices left at the beginning of the second year. Very few bacilli were found, and many of these had lost their acid fast properties. During this second year occasional nodules resembling actinomycosis were seen; these, however, did not stain by Gram, and only feebly by hæmatoxylin. After 26 months healing appeared to be complete and the bacilli to have disappeared. NECHTADIMENKO, ODRINO, SYSSAK, and ANGUENITSKI<sup>11</sup> inoculated guinea-pigs, rabbits and, later, calves subcutaneously, intraperitoneally, intravenously or intracardially with a dose of BCG which varied in amount from 0.1 mgm. to 100 mgm. The animals were killed after from 15 days to 2 months or more. It was noted in the case of guinea-pigs and rabbits that a caseous nodule, tending to ulcerate, and accompanied by a slight swelling round it, appeared at the site of inoculation, but at the end of a month and a half or two months this completely disappeared. In some cases caseous or calcareous inguinal enlargements were seen, and occasionally tubercles the size of a pea were found in the lungs, liver and spleen. Histological examination showed granulation tissue with epithelioid and giant cells, surrounded by connective tissue, and occasional fibrous tubercles in the lung and other viscera. In the cases where large doses had been given specific tuberculous lesions appeared, but these were not capable of reinoculation into other animals. Large doses injected intraperitoneally gave rise to tubercles in the peritoneum, but after two or three months no specific lesions were found except in the mesenteric and inguinal glands, where bacilli morphologically identical with *Myco. tuberculosis* were found. Intracardiac inoculation produced tubercles in the lungs and sometimes in the pericardium, but although histological examination showed epithelioid and giant cells, after two months these had disappeared. Experiments designed to increase the virulence of the BCG by transferring it from one guinea-pig to another by using an emulsion of the organs which appeared to be highly tuberculous proved to be unsuccessful. Similar experiments, also unsuccessful, were performed on 25 rabbits. In a further series of experiments by inoculating rabbits and guinea-pigs with doses varying from 0.1 to 100 mgm. it was shown that vaccinated animals survived control animals by a period varying from two to six and a half months. The authors concluded from their experiments that BCG might produce tuberculous lesions in organs, but that these disappeared naturally, and that the lesions thus produced could not be reinoculated.

ELBERT and GELBERG<sup>15</sup> employed the method of inoculating guinea-pigs intraperitoneally with 50 mgm. of BCG or intratesticularly with 10 mgm., and then making cultures from the resulting local lesions at intervals afterwards. For the first two weeks after inoculation BCG was isolated very readily from the local lesions, but later it was found that the bacilli gradually lost their vitality; the number of colonies diminished, and they took a longer time to appear. With material taken during the first weeks after inoculation colonies were visible after eight to fourteen days, but in the case of older lesions (92 to 97 days) no colonies appeared before the fifth week, and in one instance when the material was sown 294 days after inoculation, out of 16 tubes only one colony was isolated after 80 days, thus showing a gradual loss of the power of subculture of BCG isolated after varying times. The cultures, after ten successive passages, were reinoculated into 169 guinea-pigs, and



showed no increase in virulence on the original strain. In other words, BCG was found by the authors to be perfectly stable in virulence.

MALKANI<sup>16</sup> obtained, however, less favourable results. He inoculated 28 guinea-pigs and 18 rabbits, and at autopsy at the end of 16 weeks (the maximum period of observation) nine animals showed no lesions, whilst in twelve others the lesion was confined to the site of inoculation. In 18 other animals the process had extended beyond the site of inoculation, these lesions varying from deposits in the kidney in some instances to very extensive caseous tuberculosis of the lungs and kidneys in one instance (a rabbit). The author considered that BCG still showed virulence and had not, in spite of long cultivation on bile-potato medium, acquired an attenuation of such a nature as might distinguish it from strains incompletely attenuated by other means. He believed that the conflicting results obtained by some workers would lead one to conclude that BCG had not yet acquired such permanent characteristics as may justify its being classed as a *Virus fixe* in the sense of the Pasteurian anthrax vaccines.

Administered parenterally, BCG had been found to set up typical tubercles in guinea-pigs and rabbits. The pathological picture was not uniform, however, in all animals, and the details of autopsies and their analysis showed that some animals might reveal lesions in the organs, others only at the site of inoculation, and yet others might show none, although inoculated with higher doses by the same route. Only up to a certain point, therefore, could BCG be said to be innocuous.

At this point it is pertinent to raise the point brought forward by PETROFF and BRANCH<sup>17</sup> (abstracted in this *Bulletin*, 1929, v. 4, 156), that two types of colony, rough and smooth, could be separated from BCG culture. These authors stated that their work so far pointed to the fact that these two colonies dissociated from the original Calmette strain behave differently, not only in regard to cultural characteristics, but also in virulence for guinea-pigs and rabbits. They took the rough type of colony to be non-virulent and the smooth to be virulent for guinea-pigs, and believed that by continuous subculture CALMETTE had eliminated most of the smooth colonies, but that the small numbers of this colony left might, under favourable circumstances, sufficiently increase in numbers to lead to reversal of virulence. As far as we are aware, the work of PETROFF and BRANCH on this point has not yet been confirmed.

TZEKNOVITZER,<sup>18</sup> reporting part of the work of the Ukrainian Commission on BCG, gave details of experiments with rough and smooth colonies, using, in addition to BCG, other acid fast bacilli. They found that the two types were not stable, and that it was possible to transform one type into another. Subcutaneous guinea-pig inoculation showed that rough and smooth colonies of Timothy grass, smegma bacillus and BCG presented no tuberculous lesions. On the contrary, both rough and smooth colonies of various virulent strains produced, when inoculated, progressive tuberculosis. Rough and smooth colonies of BCG when mixed with virulent tubercle bacilli also produced progressive lesions. Experiment on the virulence of three successive generations of cultures of BCG isolated from rough and smooth colonies were completely negative with guinea-pig experiment, whilst passage experiments by the intratesticular route with rough and smooth colonies of BCG were also negative. After comparing the colonies with the photographs of PETROFF it was believed that they were identical. The report stated that rough and smooth and intermediate types of colony could be dissociated from all acid fast strains investigated, and that the morphological character of the colonies was absolutely independent of their virulence. Rough and smooth colonies isolated from avirulent cultures were avirulent, whilst in cultures of mixed BCG and virulent bacilli rough and smooth colonies were sometimes avirulent and sometimes virulent. The writer of the report considered, therefore, that PETROFF had drawn erroneous conclusions.

With regard to BCG vaccination in cattle, the original reports of CALMETTE and his co-workers stated that successful vaccination of cattle, if carried out within 15 days of birth, could be effected by a single inoculation of 50 to 100 mgm. of BCG, this inoculation being renewed at the end of each year. The figures for the animals vaccinated during the first year of the test were 1,295 in France, Germany, Holland and Belgium.

WATSON<sup>19</sup> reported to the Eleventh International Veterinary Congress in 1930 the results of five years of experiment made under the Canadian Government. Only Government-owned cattle were used, consisting in part of a tuberculous herd acquired from one of the Government Experimental Farms, and in part of purchased healthy cattle from accredited tuberculosis-free herds. The calves were segregated at birth, fed with either pasteurized milk or milk from tuberculin tested,

non-reacting cows, and vaccinated within the first week of life. Two kinds of vaccine were used, viz. : (1) BCG ; (2) moderately virulent tubercle bacilli. An unvaccinated group was also reserved as a control. These three groups were then tested by : (a) experimental inoculation of measured doses of virulent tubercle bacilli ; (b) ingestion of virulent bacilli ; (c) natural exposure to tuberculosis infection under farm conditions. The trials varied in duration from a few months up to four and a half years. Laboratory autopsies on 72 cattle revealed evidence of tuberculous lesions in 78.4 per cent. of cattle vaccinated with BCG, 90 per cent. of cattle vaccinated with virulent bovine tubercle bacilli, and in 75.0 per cent. of the unvaccinated controls. While slight percentage differences, in trials of varying duration and with a limited number of animals, have little significance, it was fairly evident that there were no striking differences between the cattle vaccinated with BCG, those vaccinated with virulent tubercle bacilli, and the unvaccinated controls, in respect to autopsy evidence of tuberculosis lesions. With regard to the relative extent of lesions there was some evidence that in trials of short duration BCG vaccination might retard the development of infection. This, however, seemed more or less transient, and in spite of re-vaccinations diminished with time and as the cattle continued under exposure to natural reinfection.

A comparative study over a period of five to six years therefore did not substantiate the claims made for BCG vaccination as an efficient means of protection against bovine tuberculosis. The opinion was given that with the results thus far obtained and the knowledge available, the use of BCG was contra-indicated in the control of bovine tuberculosis in Canada, where the incidence of the disease and the conditions that prevail were favourable to the success of drastic methods aiming at the destruction of the sources of infection.

To sum up, BCG must, we believe, still be regarded as *sub judice*. It is a pity that the culture was broadcast so extensively. A few carefully controlled experiments observed over a long period would have served the purpose better. The following conclusions are suggested : (1) there appear to be no immediate effects, harmful or otherwise, from oral ingestion of the vaccine ; (2) local abscesses from which bacilli are recoverable may follow subcutaneous or intramuscular inoculation ; (3) the end results are difficult to assess at this stage, especially in the absence of adequate statistical control ; (4) the reports on autopsies so far performed on vaccinated children are brief and incomplete ; (5) experiments on small laboratory animals have given variable results, local non-progressive lesions have been reported in considerable numbers, and progressive and fatal tuberculosis in a few ; and (6) with the exception of WATSON'S report from Canada the results in cattle have been encouraging, but here again more statistical control is urgently needed.

#### REFERENCES.

- <sup>1</sup> CALMETTE, A., GUERIN, C., NEGRE, L., and BOQUET, A. (1926.) *Ann. Inst. Pasteur.* 40, 89.
- <sup>2</sup> BULLETIN OF HYGIENE, 1926, 1, 770.
- <sup>3</sup> CALMETTE, A. (1927.) La vaccination preventive contre la tuberculose par le "BCG." 250 pp. Paris : Masson et Cie. [22 fr.]
- <sup>4</sup> —. (1928.) L'infection bacillaire et la tuberculose chez l'homme et chez les animaux. 3rd Edition. 883 pp. Paris : Masson et Cie. [125 fr.]
- <sup>5</sup> QUARTERLY CUMULATIVE INDEX MEDICUS, 1928-30, 3-7.
- <sup>6</sup> CALMETTE, A. (1928.) *Ann. Inst. Pasteur.* 42, 1.
- <sup>7</sup> GREENWOOD, M. (1928.) *Brit. M. J.* (i), 793.
- <sup>8</sup> CALMETTE, A. (1930.) *Ztschr. f. Tuberkulose.* 58, 129.
- <sup>9</sup> LEAGUE OF NATIONS. Health Committee. Report to Council. 1928, III, 16, page 28 ; and Minutes of Thirteenth Session. 1929, III, 1, page 36.
- <sup>10</sup> LANGE, L. (1930.) *Klin. Woch.* 9, 1105.
- <sup>11</sup> NECHTADIMENKO, M., ODRINO, O., SYSSAK, M., and ANGUENITSKI, I. (1930.) *Ann. Inst. Pasteur.* 45, 54.
- <sup>12</sup> CHAUSSINAND, R., *Ibid.* 71.
- <sup>13</sup> —, and TEMPE, G. *Ibid.* 65.
- <sup>14</sup> ZEYLAND, J. *Ibid.* 157.
- <sup>15</sup> ELBERT, B., and GELBERG, S. *Ibid.* 59.
- <sup>16</sup> MALKANI, M. (1930.) *Tubercle.* 11, 433.
- <sup>17</sup> PETROFF, S. A., and BRANCH, A. (1928.) *Amer. J. Pub. Health.* 18, 843.
- <sup>18</sup> TZEKMOVITZER, M. (1930.) *Ann. Inst. Pasteur.* 45, 162.
- <sup>19</sup> WATSON, E. A. (1930.) A Comparative Study of Vaccination with Living Tubercle Bacilli and with Special Reference to BCG. Report of Eleventh International Veterinary Congress, London. 26 pp.



BUXTON, J. B., and GRIFFITH, A. S. (1931.) **The Use of BCG in the Vaccination of Calves against Tuberculosis.** *Lancet*. February 21st. 393-401. 2 figs. [22 refs.]

This is an interim report. One of the authors [A. S. G.] carried out two preliminary experiments in 1926, one with BCG and one with attenuated human bacilli, and found that the resistance of a calf could be raised to such a degree as to enable it to resist completely the intravenous inoculation of 1.0 mg. of fully virulent bovine bacilli.

**PREPARATION OF THE VACCINE.**—Cultures of BCG were grown upon coagulated 5 per cent. glycerine egg and used when they were three to seven days old. The growths were carefully lifted from the medium, weighed, ground up and suspended in saline.

**THE EFFECTS OF BCG.**—Three calves, inoculated intravenously, died or were killed 21, 27 and 106 days after injection; no macroscopic tuberculous lesions could be found; BCG was recovered in culture from the first two calves, but not from the last. One calf inoculated subcutaneously, died 47 days later and an encapsulated caseous and softened local lesion was the only abnormality that could be found: BCG was recovered in culture from the lesion and from the prescapular and bronchial glands. Of two calves fed with BCG, one died 76 days, and the other was killed 72 days, after the last dose. Neither showed any sign of tuberculosis; cultures from the mesenteric glands did not yield a growth of BCG.

Fifty-one calves which had given negative reactions to the double intradermal tuberculin test were inoculated or fed with BCG. Subcutaneous inoculation and administration by ingestion did not cause any disturbance in health; intravenous inoculation with small doses was generally well borne; large doses, given intravenously, usually caused illness which lasted for about a week. A second injection with BCG, given three weeks to a month after the first, was not infrequently followed by an acute rise in temperature and malaise for about a week.

**RESISTANCE OF VACCINATED CALVES.**—The intravenous inoculation of the test bacilli produced an acute febrile reaction with general malaise in the great majority of the vaccinated calves. The test dose throughout consisted of bacilli taken from five to seven day old, actively multiplying, serum or egg cultures suspended in saline. 1 mg. of such culture was considered to be too much, so in most instances 0.25 mg. [about ten million bacilli] was used in order to bring out more clearly the slighter grades of increased resistance in young calves. Even this test was a severe one and more than would usually be encountered in natural conditions.

The experiments were carried out in six different series.

**SUMMARY OF THE EXPERIMENTS.**—51 calves were vaccinated with BCG by various methods—ten by feeding, four by intratracheal, three by subcutaneous and 34 by intravenous injection. They were subsequently tested, along with twelve untreated calves, by the intravenous injection of fully virulent bovine tubercle bacilli in doses ranging from 1.0 mg. to 0.25 mg. of culture. The controls died of miliary tuberculosis in 15 to 27 days. Two other control calves given 0.1 mg. and 0.05 mg. respectively, died from general tuberculosis in 39 and 60 days. It is estimated that the test dose used on the vaccinated calves was five to twenty times the dose necessary to cause fatal general tuberculosis in normal calves. The test doses were given two and a half to three months after vaccination was commenced.

**THE EFFECT OF VACCINATION (FEEDING).**—Of the calves fed with a pipette, three showed no higher resistance than the controls, while the other three showed much higher resistance, amounting in one instance to complete immunity. Of the calves given the vaccine in food, two showed a slightly higher resistance than the controls, and two showed much higher resistance.

**SUBCUTANEOUS INOCULATION.**—Of three calves inoculated, there was little, if any, resistance in one, slightly increased resistance in another, and a moderately high degree of resistance in the third.

**INTRATRACHEAL INJECTION.**—Of four calves inoculated there was little, if any, increase in resistance in two, some increase in one, and a very high degree of resistance in the fourth.

**INTRAVENOUS INOCULATION.**—Thirty-four calves were treated, and all except one showed increased resistance, but there were great individual variations.

“With regard to the degree of protection afforded by different doses of BCG intravenously, it is interesting to note that only 50 per cent. of each group of calves vaccinated with 10 and 50 mg. and 10 and 75 mg. respectively showed a high degree of resistance to the test bacilli, whereas 75 per cent. of the 20 calves vaccinated with 10 and 100 mg. of BCG were highly resistant.

"The actual cause determining the death of the great majority of the resistant animals was tuberculosis of the central nervous system; this was due to the fact that the test dose, consisting of a large number of highly virulent tubercle bacilli, was injected intravenously, a few of the test organisms thus gaining access to the central nervous system, where they were able to produce lesions owing to the low degree of resistance common in this situation. The tuberculosis elsewhere was not severe.

"These results are much more encouraging than may appear at first sight. It must be remembered that although the test doses employed throughout the experiments were exceedingly severe, the life of 23 of the 51 vaccinated animals was prolonged for periods ranging from eight months to three years, and the great majority of the remainder showed definitely increased resistance. There is little doubt that a less severe test dose administered so as to resemble more closely a natural infection would have given more spectacular results. It is proposed to adopt the former course in future experiments, since we are now satisfied that a high degree of immunity can be induced in calves when BCG vaccine is used in the most appropriate manner."

**CONCLUSIONS.**—The authors conclude that the strain of BCG used in the experiments was avirulent for calves. Vaccination with BCG, whether by feeding, or by intratracheal, subcutaneous or intravenous inoculation, can raise the resistance of calves. An increase in resistance was less certain after feeding than after intravenous inoculation, and intravenous inoculation gave the best results. The resistance produced was apparently proportional to the dose of the vaccine.

PIAZECKA-ZEYLAND, E. (1930.) Isolement du BCG des ganglions lymphatiques des cobayes vaccinés per ingestion. [The Isolation of BCG from the Lymphatic glands of Guinea-pigs Vaccinated by Ingestion.] *Ann. Inst. Pasteur.* 45. 439-442. [3 tables.]

The author refers to previous publications in which a method was described whereby it was found possible to detect the presence of BCG in children vaccinated *per os* and dying of diseases other than tuberculosis. He succeeded in doing this in one-third of the cases examined.

The present paper records the results of experiments with guinea-pigs. Tabular statements show the results obtained with three series of guinea-pigs vaccinated by the oral administration of 30 mg. of BCG divided into a number of doses and given on a succession of days. Details are given of intradermal tests carried out on two of the series, and also the results of cultures put up from the cervical and mesenteric glands when the guinea-pigs of the three series were tested at two to four weeks, three months, and five to six months, after the ingestion of the BCG.

These show that, while at two to four weeks after ingestion all cultures were positive, only a proportion of tubes yielded growths after three months, while no cultures were obtained from the guinea-pigs left for five to six months before they were killed.

ELBERT, B., and GELBERG, S. (1930.) Nouvelles contributions à l'étude expérimentale du BCG. [Fresh Contributions to the Experimental Study of BCG.] *Ann. Inst. Pasteur.* 45. 59-64. [1 Table.]

The authors were able to obtain cultures from the caseous lesions, caused by BCG in guinea-pigs, up to 284 days after inoculation, but the difficulty of obtaining such cultures increased with the period during which the bacilli were in the animal body. After 100 days the percentage of positive results was 66. Glycerinated potato becomes a less and less favourable medium for recovery of the bacilli as the period elapsing after inoculation increases, but cultures are readily obtainable on egg media.

The authors found that this progressive loss of aptitude to grow on artificial culture media is one of the permanent characters of the strain. While it is generally agreed that BCG itself is harmless, much discussion has arisen regarding the capacity of the strain to recover virulence by passage through animals.

The BCG was put through ten passages in guinea-pigs, being recovered in culture after each passage, and again injected in large doses [50 mg.]. In the course of the series, the bacilli were recovered from guinea-pigs up to the 284th day after inoculation. A parallel set of inoculations was made with first or second generation cultures about three weeks old as controls. There was no appreciable difference in the lesions produced in the two series.



NECHTADIMENKO, M., ODRINA, O., SYSSAK, M., and ANGUENITSKI, I. (1930.) La Vaccination préventive de la Tuberculose par le BCG à Kiev. [Protective Inoculation against Tuberculosis by BCG at Kieff.] *Ann. Inst. Pasteur.* 45. 54-58.

The authors first carried out experiments for the purpose of convincing themselves of the harmlessness of the vaccine. Doses ranging from 0.1 mg. to 100 mg. and even 1 g. were used, but for the most part 20 mg. were given. Rabbits and guinea-pigs, and latterly calves, were inoculated subcutaneously, intraperitoneally, intravenously and intracardially.

Subcutaneous inoculation with large doses produced a caseating and ulcerating lesion which healed completely. In some cases caseous centres were found in the nearest lymphatic gland, and in the lungs, liver and spleen.

With doses of 100 mg. or more, and with smaller doses given repeatedly, a fatal termination resulted from tuberculosis. The animals showed no loss of condition, however, and the infection could not be carried on in series.

Intraperitoneal injections of 20 mg. caused peritoneal infection, but the lesions disappeared spontaneously within about a month. There was sometimes persistent infection of the mesenteric glands, and recognisable bacilli could be discovered in them.

Intracardial inoculation produced disseminated lesions which healed spontaneously. Repeated attempts have been made, always without success, to exalt the virulence of the organisms by passage through guinea-pigs and rabbits.

Employing the technique of PETROFF, BRANCH and STENKEN, the authors have separated "S" and "R" types. Neither of these was found capable of producing progressive tuberculosis. They are unable to confirm Petroff's opinion that virulent colonies can be obtained from BCG.

The test inoculations were given at intervals ranging from one to five months later. The premunished animals survived the controls by periods ranging from two and a half to six and a half months.

From the end of 1926 up to April 1st, 1930, 155 infants were vaccinated, and about half of these were constantly under bad hygienic conditions and in close contact with tuberculosis. It is said that the majority of these are now more than two and a half years old, and that 76 per cent. have developed normally. Ninety per cent. of those brought up in healthy surroundings have developed normally. Three cases of benign infection with recovery occurred in the first group, and a total of five deaths has been recorded. Only one of these was due to tuberculosis, which was generalised and due to the human type of bacillus.

NÉLIS, P. (1930.) Sur l'absorption du BCG administré *per os* au cobaye nouveau-né. [Absorption of BCG Vaccine when Administered *per os* to the New-born Guinea-pig.] *C.R. Soc. Biol.* 104. 1187-1188.

The author had previously demonstrated that, when *Mycobacterium phlei* was administered *per os*, it was easily absorbed through the digestive tract of the young guinea-pig and young rabbit. He decided to ascertain whether BCG vaccine could be recovered by hæmoculture or from the lungs after administration *per os*. As previous attempts to prove this point had failed owing to faulty technique, he elaborated a satisfactory procedure. He concluded that BCG vaccine, like *Mycobacterium phlei*, passed through the mucous membrane of the digestive tract of young guinea-pigs and could be recovered from the peripheral blood or from the tissue of the lungs, one to one and a half hours after administration.

NINNI, G. (1930.) Résultats de l'inoculation de produits suspects de tuberculose dans les ganglions lymphatiques. [The Results of the Inoculation into the Lymphatic Glands of Materials Suspected of being Tuberculous. *Ann. Inst. Pasteur.* 45. 433-438.

The author makes a brief reference to his earlier papers on the method of detecting the ultra-virus of tuberculosis present in young cultures by direct inoculation into the cervical lymphatic glands of the guinea-pig. In these experiments acid-fast bacilli could be detected in the glands in eight to fifteen days after inoculation.

It occurred to him that it might be possible to prove the presence of tubercle bacilli in suspected



materials by injecting them directly into the glands. The materials used comprised pleural exudate, pneumonic exudate, cerebro-spinal fluid, pus from suppurating glands, sputum, purulent stools from a case of dysenteriform enteritis, and secretion from purulent lupus. All the materials were from human sources. Details are given of the various methods used for preparing the materials for injection. With each sample two guinea-pigs were inoculated directly into the glands of the neck, and one subcutaneously. On the eighth day an inoculated gland was excised, and smears were examined microscopically. In the event of failure, the inoculated gland was removed from the other guinea-pig on the twelfth day and examined. The guinea-pigs were left alive for the purpose of comparing the results with those obtained by subcutaneous inoculation.

Bacilli were found in some cases in the glands removed at the eighth day, and in others in the glands removed on the twelfth day.

If the inoculated glands were not removed until 20 to 40 days after inoculation, they were found to contain veritable cultures of tubercle bacilli.

Full details are given of the results produced from intraglandular inoculation of guinea-pigs which were destroyed after periods of about six weeks. The author finds that, by inoculating material directly into glands, accidental bacteria are killed off, and the method seems to favour an exaltation of virulence.

PALLASKE-EBER, R. (1931.) Die Geflügeltuberkulose und ihre Beziehungen zur Säugetiertuberkulose. [The connection between Avian and Mammalian Tuberculosis.] *Deutsch. Tier. Woch.* **39.** 1-3.

RAEBIGER made a survey of avian tuberculosis in Saxony, and this was the first survey to be done in Germany. He found that 54 per cent. of the flocks were infected. Small farms were more heavily infected than large farms. While natural infection occurs from ingestion, it can pass to the eggs of infected hens. This is important in connection with human health.

The author quotes work of different investigators on infection of mammals with avian bacilli, and on infection of birds with mammalian bacilli. She inoculated fowls with human and with bovine bacilli, but they only developed local lesions. She discusses the types of tubercle bacilli and the work carried out to ascertain if mammalian bacilli can acquire the characters of the avian type after passage through birds. She emphasises the importance of avian tubercle bacilli, and quotes the workers who have demonstrated them in lesions in human beings, horses, cattle, sheep, goats, pigs, rabbits, rats and mice, and emphasises the frequency with which infection with the avian tubercle bacillus occurs in pigs.

SELTNER, H., and BLUMENBERG, K. (1930.) Der Wert der Augenlid-Tuberculinprobe (intrapalpebral Reaktion) zum Nachweis der Tuberkulösen Infektion des Rindes. [The Value of the Intrapalpebral Test for the Detection of Tuberculosis in Bovines.] *Berl. Tier. Woch.* **46.** 597-599.

The authors state that while in human medicine local skin tests have almost entirely displaced the subcutaneous injection of tuberculin, in veterinary practice, at least in Germany, the subcutaneous test is by far the most commonly employed. They refer briefly to the views expressed by ZWICK and WITTE regarding the relative merits of the subcutaneous and ophthalmic tests, to the results obtained by the Medical Research Council (in England) with the intradermal test, and to the experiments of VOELKER, in which tuberculin was injected into the eyelid either through the outer skin or sub-conjunctivally.

The authors' first opportunity to test the value of the intrapalpebral reaction occurred when some calves which were to be used for immunisation experiments became available. The tests were of course of immense importance. Subsequently several hundred animals from different sources were tested and examined *post-mortem*. The tuberculin adopted after the first batch of tests was a 20 per cent. dilution of "Perlsucht-tuberculin," and of this 0.5-1 c.c. was injected into the eyelid.

The authors state that slight swelling of the eyelid unaccompanied by marked congestion of the conjunctiva, must be considered as a negative non-specific reaction. Similarly, reddening of the

conjunctiva without swelling of the eyelid must be considered as a negative reaction. In doubtful cases the test may be repeated in the course of a few days.

In some of the earlier tests a 50 per cent. dilution of tuberculin was used, but in some cases this caused very severe reactions, and in one instance it was so pronounced that the animal had to be slaughtered.

NIELAND, H. (1930.) Ein Beitrag zur Diagnose des Fruhstadiums der Eutertuberkulose. [**A Contribution to the Diagnosis of the Early Stage of Tuberculosis of the Udder.**] *Zeitschr. f. Infektkr. d. Haust.* 38. 81-101. (With several tables.) [22 refs.]

A detailed account of the work done in Germany to ascertain the incidence of human tuberculosis of bovine origin, with special reference to the early diagnosis of tuberculosis of the udder of cows. The work is presented under eight headings:—general introduction; the symptoms of tuberculosis of the udder; the histology and histogenesis of tubercles of the mammary tissue; the occurrence of lymphocytes and their origin in tuberculous processes; the lymphocytes in mammary tuberculosis and their value for the diagnosis of its initial stage; microscopical technique; and a summary.

The author claims that the early stage of tuberculosis of the udder can be diagnosed by a histological examination of the cell content of the sediment of centrifuged milk. The milk from each teat must be examined separately. He supports the opinion of RAUTMANN (1928) that in early tuberculosis of the udder there is an increase in lymphocytes, but not in the other types of white blood corpuscles which are only seen in small numbers. The histological appearance of milk from a tuberculous udder presents a similar picture to that of other tuberculous exudates. The presence of numerous lymphocytes in milk sediment smears, prepared by the author's method, provides strong suspicion of tuberculosis of the udder some time before the milk appears to be abnormal or the udder is visibly diseased. The author considers that his method of milk examination can help much towards the control of tuberculosis originating from infected milk.

IVERSON, J. P. (1930.) **A Review of Tuberculosis Control in California.** *Jl. Amer. Vet. Med. Ass.* 77. 725-733.

The author draws attention to the fact that, as a result of the enactment of the Pure Milk Law (1915) of California, the sale of raw milk from any but tuberculin-tested cows is prohibited. Even cows kept to supply milk that is used by their owners and neighbours must be so tested. California was the pioneer State in this respect, and the present position after 15 years' effort is very favourable, so that in 1929, out of nearly 214,000 cows tested, 82 per cent. were free from tuberculosis. Tuberculin tests must be performed twice a year if any positive reactions have been obtained, otherwise annual testing is ordered. Positive reactors have been branded and excluded from the dairy herds since 1916, but they are not slaughtered. In two counties the percentage of reacting dairy cattle has been reduced to less than 1 per cent.

In 1921 the Tuberculosis-Free-Area Law was passed, and this gave authority for the State Department of Agriculture to undertake tuberculosis eradication co-operatively in counties desiring this service, in such counties owners are compelled to submit all their cattle to the test. Formerly, positive reactors were all slaughtered and no indemnity was paid, but in 1929 statutory provision for the payment of indemnity was made. This law also regulates the sale and use of tuberculin, only approved veterinarians being allowed to possess and use it. Most counties in California have local laws prohibiting the introduction of untested or reacting cattle.

The author pays tribute to the splendid co-operation in tuberculosis eradication, of all parties from the Bureau of Animal Industry to the dairy farmers.

Finally he suggests that all States should enact laws in connection with the sale and use of tuberculin and with the sale of new milk, similar to those which have given such good results in California.

**Report of Special Committee of the Amer. Vet. Med. Ass. on Tuberculosis.** *Jl. Amer. Vet. Med. Ass.* 77. 507-511.

The Committee reports a general increase in the work undertaken in connection with the progress of tuberculosis eradication in the U.S.A. Three States are entirely accredited as free from



tuberculosis and 962 counties are partially accredited as well as a number of towns. During the past year, over twelve and a half million cattle were tested, and in Canada one and a half million cattle have been tested at least once. Of two Canadian provinces, one has a tuberculosis incidence of only 0.15 per cent., and the other an incidence of 2.2 per cent. The Report includes a paper by DORSET on the nature of Tuberculin.

As a result of the recommendations of the Conference on BCG vaccination, held in Paris in October, 1928, five separate investigations were instituted in North America, and the aggregate results have indicated that 61 per cent. of vaccinated and 87 per cent. of unvaccinated control cattle have been found to be tuberculous at autopsy, a difference of about 25 per cent. in favour of the vaccinated cattle. Individual results differ very much, and the later ones appear to be more unfavourable than the earlier ones. It cannot be denied that BCG vaccination when combined with other prophylactic measures does lessen the risk of infection. At its best, BCG vaccination only seems to be capable of delaying the development of tuberculous infection or of retarding progressive tuberculosis. Virulent tubercle bacilli have been recovered from lymphatic glands of inoculated cattle which were free from visible lesions, from milk and from the site of injection of the vaccine. There is no doubt that cattle vaccinated with BCG and subsequently exposed to infection, frequently become carriers of virulent tubercle bacilli. Calmette's claim that BCG is innocuous has been contested by several workers in various countries, and this subject is still of a very controversial nature.

It has been recognised that avian tuberculosis is of great importance and the fact has been established that, as much as 88.5 per cent. of localised tuberculosis in swine, is due to avian tubercle bacilli. These organisms can remain viable in barnyard soils for two years; and rats, as well as sparrows and other birds, are definitely mechanical carriers of avian tuberculosis. Many state officials are dealing with this problem, and it is hoped that the situation will improve.

TSUGE, Kazuo. (1930.) **Experimental Studies on the Tuberculin Hypersensitiveness.** *Select. Contrib. Mukden Inst. for Infect. Dis. of Animals.* 1. 213. [From English Summary.]

The author used rabbits in experiments carried out to study hypersensitiveness to products of the tubercle bacillus, and he used the tuberculin ophthalmic reaction to test his results. He was able to render rabbits hypersensitive to tubercle bacilli killed by heat at 65°-70° C., and at 100° C. Rabbits were rendered hypersensitive by a specific tuberculin serum; the serum was inactivated when it was heated at 100° C. and when it was completely absorbed with living or heated tubercle bacilli.

BEKKER, J. G. (1930.) **A Note on the Addition of Glycerine as a Preservative for Anthrax Spore Vaccine.** *16th Rep., Direct. Vet. Ser. and Anim. Indust., Union of S. Africa.* pp. 147-148. Pretoria: Govt. Printer.

The tests carried out by the author were designed to show whether the percentage of glycerine used in the solution employed as the vehicle for the Laboratory Anthrax vaccine is unnecessarily high. The solution is "made up by adding 60 per cent. glycerine to 40 per cent. normal saline (by volume)."

Ordinary agar and ordinary broth were used for the tests and, to these, ascending percentages of glycerine were added. Tubes were then inoculated with spore vaccine and also with *B. subtilis* spores, and incubated at 37° C. In no case did any growth take place in the tubes containing media with 40 per cent. of glycerine added. The conclusion is drawn that 40 per cent. glycerine is a sufficient preservative.

DERFLINGER, E. R. (1931.) **Control of Anthrax in Live Stock of the North-west.** *Jl. Amer. Vet. Med. Ass.* 78. 42-56.

The author is a member of the Oregon State Live Stock Sanitary Board, and describes work done in that State. During the summer of 1928 anthrax appeared, probably for the first time in Oregon, in grazing beef cattle in an irrigated valley. Flies were probably responsible for spreading

infection to some extent. Simultaneous inoculation with anti-anthrax serum and spore vaccination was used with success, hygienic measures being adopted as extensively as possible.

BORDET, J., and RENAUX, E. (1930.) L'influence du calcium sur l'évolution des cultures de charbon. [The Effect of Calcium upon the Development of Anthrax Cultures.] *Ann. Inst. Pasteur.* 45. 1-25. [11 figs.]

Investigations carried out during recent years have produced a large amount of evidence relating to the variability of bacteria as regards their morphology, biochemistry, pathogenicity, &c., and it is beginning to be recognised that no culture is perfectly homogeneous or remains so for any length of time. The individual organisms are not all identical and, as their characters are transmitted, more or less stable varieties are thus produced. Modification of cultures by physical or chemical means is not in reality due to the action on the individuals, but to the change of conditions in the medium which favour the survival and multiplication of particular individuals. In this fact lies the importance of studying the capacities of cultures used for inoculation and the protective powers possessed by the body.

The authors' investigations have been directed towards the discovery of some substance which is capable of playing a recognisable part in producing such modifications and, using the anthrax bacillus as their test organism, they found that calcium is one such substance.

It has been found that on ordinary agar the anthrax bacillus tends to develop colonies of two types in a manner parallel with the development of the rough and smooth colonies of *B. coli*, but distinction between the types is not so simple because sporulation changes the appearance of the colonies, and because secondary growths may occur.

It can, however, be shown that the composition of the nutritive medium, and particularly its calcium content, often exercises a marked influence upon both sporulation and secondary growth.

A detailed account is given of the appearances presented by a culture of anthrax bacilli on the surface of agar, and of the changes ensuing as the result of sporulation. Special attention is drawn to the fact that certain colonies in an ordinary agar culture present rather unusual characters; they are whiter, less like frosted glass, and more rounded than normal colonies. These colonies appear to be less filamentous in structure and tend to sporulate far more slowly than the typical filaments. Secondary colonies develop upon the surface of the primary growth; they become transparent, excavated in the centre, and develop raised margins. Microscopic examination shows that these are composed of spores and débris. The authors prefer to call the two types of growth given by the anthrax bacillus "A" and "B," rather than to state definitely that they represent "R" and "S" varieties. Tertiary colonies which are button-like and opaque may also be found in cultures. Their appearance is such as to raise the suspicion that they are contaminations.

It has been recognised for many years that some anthrax cultures on agar do not undergo the changes described, and that some retain their original appearance. These cultures possess only a feeble capacity to form spores, and this explains the persistence of the primary macroscopic characters. The sporogenous and the asporogenous types can be separated from each other by repeated plating, but it must be remembered that there is not a sharp demarcation between the two. As regards their power of sporulation intermediate types exist. The separate types are very stable, even after passage in series through guinea-pigs. Frequent subcultivation [daily] has been shown by EISENBERG to lead to the production of the asporogenous type.

If subcultures are made in series, starting from asporogenous "button colonies," (1) on agar deprived of calcium by the addition of sodium oxalate and (2) on agar containing an excess of calcium from the addition of calcium chloride, it is found that deprivation of calcium favours the persistence of the asporogenous type, while excess of calcium favours the formation of spores.

Studying the two types "A" and "B" on the two culture media referred to, the authors are inclined to think that, on either medium, type "A" may pass into type "B," and that, on the medium with excess of calcium, type "A" tends to become asporogenous. But it can be rendered sporogenous again by maintaining it for a sufficient length of time in oxalate medium.

Long continued cultivation on medium with excess of calcium leads to the production of two types, namely "B," and asporogenous "A"; the ordinary type "A" does not occur, because calcium has the effect of rendering "A" asporogenous. The type "B" is very virulent, while the asporogenous type "A" is absolutely harmless for guinea-pigs and confers no immunity



against type "B." In fact, an excellent method of keeping anthrax cultures virulent and retaining their capacity to form spores is to grow them on oxalated media.

The asporogenous filamentous form of the bacillus, particularly in liquid media, shows a marked tendency to capsule formation.

Capsule formation is observed on oxalate agar but not on ordinary agar; transfer to calcium agar causes the immediate disappearance of this character.

BORDET, Paul. (1930.) Influence du calcium sur les caractères des espèces microbiennes. [**The Effect of Calcium upon the Characters of Microbial Species.**] *Ann. Inst. Pasteur.* **45.** 26-41. [19 figs.]

In view of the influence exerted upon bacteria by the medium in which they are placed, an influence which may show itself by biological or morphological changes, the author emphasises the necessity of constant conditions in connection with classification. Simple changes in the composition of media employed may exert a profound effect upon the organisms grown in them.

In the present paper the author deals at considerable length with the part played by calcium in bringing about such changes.

The media used in the experiments were prepared as follows :-Equal quantities of broth have added to them 10 per cent. of 2 per cent. sodium oxalate solution and distilled water respectively, 2 per cent. agar is added, and the medium is tubed. The tubes containing the non-oxalated medium are re-melted, and each receives four drops of 1 per cent. solution of calcium chloride. There are thus available tubes containing agar with about two per thousand oxalate, and tubes of agar which contain a slight excess of calcium.

Deprivation of calcium favours sporulation and seems even to allow of the production of spores by species which normally are non-sporulating, and the author gives in detail the results obtained with certain organisms isolated from the air, to support this view.

With regard to the effect of calcium upon pigment-production, the author gives details of tests carried out with *Micrococcus prodigiosus*. On oxalate medium the colour developed is bright red, while on calcium medium it is pale pink to white. Two explanations suggest themselves. Either calcium directly affects the production of pigment, or it favours the development of individuals which are feeble pigment producers, and the latter seems to be the more probable of the two. The colour of cultures on ordinary agar lies between those given on the special media, and it would seem that two varieties of *M. prodigiosus* exist—one red, and the other white. This view is supported by the fact that, by repeated subcultivation, white and red colonies can be isolated. Subcultures from these colonies are not true to type because pink colonies develop from the white and paler red from the red. These differences disappear with a succession of sub-cultivations.

The author has carried out experiments with the diphtheria bacillus with a view to determining whether oxalation of the medium has any effect upon the production of toxin. The results appear to indicate that it has no such influence.

The author has been able to show that oxalation of the medium is capable of effecting alterations in the morphology of organisms isolated from the air, but with the pathogenic bacteria tested by him no such changes have been produced.

DUNNING, F. J. (1931.) **Observations on Glanders at the End of the South-West African Campaign, 1915.** *Vet. Rec.* **11.** 11-12.

This short article is more historical than scientific. It deals with a sudden outbreak of glanders which occurred among a large number of horses and donkeys that were brought together in a concentration camp from many different Corps and Forces at the end of the South-West African Campaign. Glanders broke out when there was a lack of proper food and watering facilities. The author considers that, where it is impossible to provide for such unusual conditions as occurred and to arrange proper feeding, regular inspection and immediate mallein testing, it would be better to turn the animals out immediately in small batches on suitable farms in the vicinity of rail or good motor communication, as this would decentralise them sufficiently to prevent outbreaks from becoming epizootics. Amongst equines turned loose on such farms, clinical cases of glanders could be destroyed at once. The disease would thus have comparatively little opportunity to spread, and testing could be undertaken when mallein and veterinary services become available.



ESSEX, Hiram. E., MCKENNEY, Frank D., and MANN, Frank C. (1930.) *Pseudomonas Pyocyanea* a Significant Factor in a Disease of Chickens. *Jl. Amer. Vet. Med. Ass.* **77**. 174-184. [8 refs.]

*Pseudomonas pyocyanea* was isolated from 48 out of 50 chicks in a flock of 400 which became affected with a disease that killed off 75 per cent. of them.

Symptoms were: respiratory disorder, great depression, anaemia and high temperature. The appetite was unaffected, and chicks when disturbed became quite active until left alone again. Ophthalmo-conjunctivitis occurred in the late stages. At autopsy the only change observed was intense congestion of internal organs. Anaemia and leucopenia were present. The organism recovered was found to be markedly pathogenic for rabbits and guinea-pigs. Cultures inoculated intravenously into chicks were either fatal within a short time (one to two days), or caused only a transient malaise. Chicks resisted feeding with cultures. Adult fowls were much more resistant.

Agglutinins were present in the blood serum of recovered chicks. The authors conclude with a discussion on the pathogenic action of *Pseudomonas pyocyanea* in human and veterinary medicine.

USSTUPNI, D. I. (1929.) *Flavo-Bacterium abortus equi*. n.sp. *Tierarz. Runds.* **35**. 253-257. [5 tables.]

This is an account of an organism isolated by the author from cases of equine infectious abortion which occurred in a number of studs in Russia between 1926 and 1927, when the disease reached epizootic proportions. It was cultivated from blood, from foetal membranes, and from aborted foetuses, and was considered to belong to the *Salmonella* group.

CHARACTERS OF THE ORGANISM. A motile, non-sporulating, non-capsulated, gram-negative cocco-bacillus with rounded ends, 1 to 1.5  $\mu$  long by 0.5 to 0.6  $\mu$  broad.

Growth is favoured by the addition of ascitic fluid or blood to culture media. Colonies which grow slowly, are colourless, transparent, and slightly opalescent at first but, in three days, are 2-3 mm. in diameter, and have smooth edges, a glistening surface, and a golden-yellow colour. Broth becomes turbid, and there is a slight deposit. There is no production of indol or of sulphur dioxide, but some ammonia is produced. Lactose is unchanged. Acid and gas are formed from glucose and acid but no gas is formed with mannite, maltose, saccharose and laevulose. Milk is unaltered. Freshly isolated cultures liquify gelatine. Cultures die out unless they are transferred every third or fourth day.

PATHOGENICITY. The organism causes abortion on the third to the fifth day when injected intraperitoneally in amounts of 0.2-0.5 c.c. into pregnant guinea-pigs and white rats. Of two mares, in the ninth month of gestation, injected with 10 c.c. of a suspension from an agar culture, one aborted in five days.

DIFFERENTIATION FROM SIMILAR BACTERIA. (1) *Salmonella abortivo-equinus* differs in its growth on gelatine and agar, the character of its colonies and its biochemical reactions. (2) *Flavobacterium aromaticum* Bergey, coagulates milk, ferments carbohydrates with gas formation, and has an aromatic odour. (3) *Flavobacterium schirokikhi* is very similar, but diff. in its characteristic growth on agar in the form of star-shaped colonies with a whitish centre and delicate bluish streaks at the periphery. It is not an organism that is associated with abortion.

SEROLOGY. The serum of a rabbit immunised against one of the six strains of *Flavobact. abortus equi* in the author's possession, agglutinated the other five strains up to a titre of 1 : 8,000, and also other organisms of the *Salmonella* group. Serum specific for the latter, agglutinated *Flavobact. abortus equi* but in a low titre.

The author carried out a large series of serological tests in connection with equine abortion in the Saal district of Germany, and proposed to carry out vaccinations with killed cultures of the organism.

GURWITSCH, B. M. (1930.) Experimentelle Studien über die Vakzination (*per os* und subkutan) gegen den infektiösen (paratyphösen) Abortus der Stuten. [Experimental Investigations of Vaccination (*per os* and subcutaneously) against Infectious (paratyphoid) Abortion in Mares.] *Zeitschr. f. Infektkr. d. Haust.* **38**. 23-35. [21 refs.]

References in the literature appear to indicate that the incidence of contagious abortion in mares

can be markedly reduced or even completely eradicated by vaccination coupled with proper sanitary measures. There is, however, a difference of opinion regarding the best method of preparing and using the vaccine, the duration of the immunity produced, and even whether the use of the vaccine is actually essential.

The author has tried vaccination by subcutaneous injection and also *per os*.

1. SUBCUTANEOUS VACCINATION.—The vaccine used was prepared from 50 strains of *B. abortivo-equinus*, the growths on agar plates being washed off in normal saline containing 0.2 per cent. formalin and the emulsion being incubated for 24 hours. 1 c.c. of vaccine contained 2,500 million organisms.

Six pregnant mares were each given three progressively larger doses—the extremes of which ranged from about 2 c.c. to 10 c.c.—at intervals of a week. There was some amount of local and general reaction in every case.

Agglutinins appeared in the blood, but the quantity appeared to be more closely related to the number of bacteria injected than to the extent of the animal's reaction.

The maximum agglutinin content appeared to be present between the seventh and the seventeenth days after vaccination. Twenty-five days after the final dose of vaccine, the agglutinin content was markedly lower.

The mares were then divided into two groups; those of one group, along with one control, were injected intravenously with a mixture of strains of the bacillus of equine abortion, and those of the other group, with two controls, were given culture *per os*. There appeared to be no difference in the degree of systemic disturbance shown by vaccinated animals tested by intravenous injection and by the controls but, in the case of the test infection given *per os*, the controls reacted in a far more pronounced fashion.

Of the two mares tested by intravenous injection, one aborted and one died, and of the four infected *per os*, two foaled normally and the foals of the other two died of "joint ill." From one of the foals *B. abortivo-equinus* was isolated.

II. VACCINATION *per os*.—The author states that previous experiments carried out by him have shown that mares become infected with equine abortion by way of the intestine. In view of the literature regarding local immunity and the immunisation of tissues he decided to try vaccination *per os*, using for the purpose vaccine prepared as for the subcutaneous inoculation but of about twice the bacterial density.

Eleven pregnant mares were used—six for experimental immunisation and five as controls. Half an hour prior to the administration of the vaccine, which was effected with the stomach tube, the mares were each given 20 c.c. of fresh ox bile. One or two of the animals showed a slight rise of temperature, but otherwise there was no reaction. The dose of vaccine was 100 c.c.

Three days later 20 c.c. of bile were given, followed at an interval of about three-quarters of an hour by 120 c.c. of vaccine. Again there was a slight rise of temperature in one animal.

The serum of each mare had been tested by agglutination prior to vaccination with negative results. After vaccination, two of the animals gave positive reactions and the remainder negative.

Twenty-three days after vaccination, test doses of 300 to 500 c.c. of emulsion were given by the stomach tube to all the mares, three of which together with two controls had previously been given 20 c.c. of fresh ox bile.

With the exception of one of the controls all the mares showed systemic disturbance. All of them reacted to agglutination titres ranging from 1:200 to 1:300,000. Three of the vaccinated animals aborted and none of the controls, and one foal died on the day of birth. From this foal and from the three foetuses, *B. abortivo-equinus* was isolated. Agglutination tests were carried out with these four mares at weekly intervals after abortion and the maximum titre ranged from 1:700 to 1:500,000. The higher figure was given by one of the mares three weeks after abortion.

The author concludes that his attempt to vaccinate by the intestine actually rendered the animal more sensitive to infection—at least, this appears to be indicated by the results. Whether this be the case or not, it is certain that the method conferred no increased resistance to infection.

Another of the author's conclusions is that the agglutination test is of no prognostic value as a high agglutination titre does not of necessity mean that abortion will occur.

Not all mares which have aborted have a high agglutination titre. [He appears to fix his positive titre at 1:1,800 and over]. The test cannot therefore be held to be of diagnostic importance in all cases.



MIESSNER H., and SCHUTT G. (1931). Technik der Frischblutschnellagglutination zum Nachweis der Pulloruminfektion der Hühner. [The Technique of the Rapid Agglutination Test with Whole Blood in the Diagnosis of *B. pullorum* Infection in Hens]. *Deutsch. Tier. Woch.* 39. 3-4.

The rapid agglutination test with whole blood for the diagnosis of *B. pullorum* infection in hens is open to various faults, unless it is done by a special technique and the results are read by an expert. The test is performed at the farm, preferably at moulting time in the autumn when the breeder is arranging the mating. A drop of *B. pullorum* suspension is placed on a clean slide, a drop of blood taken from the comb or wattle is mixed with it and spread out into a disc. The mixture is again stirred after the slide has been moved and tilted about for a few seconds. The reaction is complete almost immediately and is more rapid in a warm atmosphere. A positive reaction is indicated by flocculation, which begins at the periphery and spreads inwards, the flocculi being compact and floating free in the fluid. In a negative reaction the fluid remains a uniformly cloudy red colour.

The result should be read against a dark background, and the observer should not wear a white coat. A concentrated antigen must be made. It should be obtained from 24 hour growths and be made from a mixture of several strains which agglutinate well, and the final suspension should be killed by carbol-saline or carbol-formalin solution and filtered. It must be tested with known positive serum before it is used. Stock antigen can be preserved for two months in a cool and dark place and must be kept for one hour at room temperature just before use. The slide must be dry and quite free from grease.

Pseudo-agglutination, due to the accidental presence of foreign matter in the fluid on the slide, can be distinguished by inspection of the flocculi which, in this case are not compact and adhere to the slide. Pseudo-agglutination also occurs in very warm weather on account of rapid coagulation. A temperature between 10° and 20° C. is necessary.

BUSHNELL, L. D., and BRANDLY, C. A. (1931.) The Reaction of the Fowl to Pullorin. *Jl. Amer. Vet. Med. Ass.* 78. 64-78. [21 refs.]

Most authors have found "pullorins" to be less reliable than agglutination tests. The authors tested four methods of preparing extracts for use in intradermal testing—an alcohol precipitated fraction of broth cultures, a cellular product consisting of broth cultures or concentrated suspensions obtained by centrifugation, an "ecto-pullorin" which is a product obtained by dissociating the cell substance in salt solution, and a substance obtained by digesting the bacilli with dilute alkali followed by dilution and neutralisation. The cellular product and the "ecto-pullorin" gave the closest correlation with the agglutination test. The author considers that further studies of methods of introducing "pullorins" into the skin are necessary.

BASSET, J. (1930.) Sur la typhose aviaire et la vaccination contre cette Salmonellose. [Avian Typhoid and Vaccination against this Salmonellosis]. *C.R. Soc. Biol.* 104. 569-571.

The author used 24 hours old broth cultures of *B. gallinarum* which produced the following results in rabbits and fowls: RABBITS: 0.5 c.c., injected intravenously, caused death in 2-3 days; autopsy showed pulmonary oedema and congestion and enlargement of the spleen. FOWLS: 0.5-1.0 c.c., injected intramuscularly, caused a local reaction but did not kill; 0.1 c.c. injected intravenously caused no disturbance in health. Four out of seven fowls inoculated intravenously with 0.25 c.c. died in 8-30 days from inanition. Five out of six fowls inoculated with 0.5 c.c. succumbed in 3-6 days. In the acute form, exudative pericarditis was sometimes seen with enlargement of the liver, with or without white foci due to the accumulation of polynuclears and eosinophils, and with enlargement of the spleen and congestion of the intestines. In the chronic form there was frequently myocarditis and enteritis, especially in the large intestine, with ulcers exceeding 3 mm. in diameter and sometimes there was a sero-fibrinous arthritis of the tibio-tarsal joints. The organism was present in all the tissues in the acute form but could not be demonstrated in the blood or bone marrow in the chronic form.

Three lots of five birds each which were vaccinated once, twice and three times respectively, were artificially infected with 0.25 to 0.5 c.c. of virus 14 days after the last inoculation. Ten of these birds including the entire third group (vaccinated three times) died, and two out of five control birds died also.

The author agrees with other workers that fowls cannot be vaccinated against fowl typhoid by conventional methods. He also considers that it is impossible to ascertain whether fowls are infected or not during life. Intradermal reactions are unreliable.

SCHMIDT, E. (1930.) Die Immunisierung von Rotlaufserumpferden unter Verwendung von Kulturen mit Methylenblauzusatz. [The Immunisation of Horses with Cultures of the Swine Erysipelas Bacillus Killed with Methylene-Blue]. *Zeitschr. f. Infektkr. d. Haust.* 38. 147-153.

Three experiments were carried out on 18 horses: seven were immunised with live cultures and eleven were immunised with cultures killed with methylene-blue.

WEICHLEIN (1927) had suggested that immunisation with culture killed with methylene-blue produces a more potent serum in horses which respond badly to ordinary antigen. The author was unable to confirm this view. He found, however, that the addition of the methylene-blue to the antigen prevented the occurrence of valvular disease of the heart and arthritis which had occurred with other antigens.

The doses of culture with methylene-blue added (300 to 500 c.c.) were relatively small in comparison with those used in immunisation with the live cultures alone (1,000 to 2,000 c.c.) and, in the latter case, concentration by means of centrifugalisation was necessary before inoculation. As the immunising effect produced was practically equal, one can conclude that methylene-blue effects blockage of the reticulo-endothelial system and helps in the production of a greater quantity of immune bodies. It appears then that, in spite of the use of smaller doses of dead culture, the added effect of the blocking of the reticulo-endothelial system by the methylene-blue, causes the formation of antibodies to as great an extent as that produced by larger doses of living culture. The author, therefore, concludes that the use of dye-vaccine on serum horses is less dangerous to them and in no way reduces the value of the serum produced.

MARSH, Hadleigh. (1931.) The Bacillus of Swine Erysipelas Associated with Arthritis in Lambs. *Jl. Am. Vet. Med. Ass.* 78. 57-63.

Gives a brief account of the work of different authors who have found the bacillus of swine erysipelas in arthritis in lambs and describes cases studied and the organism the author isolated from them.

— (1930.) Caseous Lymphadenitis ("Cheesy Gland," "Gland Disease") of Sheep. Its Cause, Distribution, Means of Spread and Suggested Methods of Control in Australia. *Jl. Sci. & Indust. Res. Australia.* 3. 147-155.

A report based on work carried out by a number of investigators. Although the disease is comparatively unimportant to the sheep's health, it is of great economic importance to the sheep-breeder in every exporting country of the world (Australia, New Zealand and South America), owing to the fact that all carcasses of mutton and lamb, imported into Great Britain and found to be infected, are rejected. Caseous lymphadenitis has been known to occur in sheep in every part of the world for the past 30 years. The discovery, two or three years ago, of a considerable percentage of somewhat heavily infected carcasses imported into Great Britain from a South American country, led to exceedingly careful inspection of a large percentage of all imported mutton, with the consequence that the infection was found to be much commoner than had been realised.

A very complete survey and study of all factors concerning the disease in Australia has been pursued during the past year by scientific workers connected with the Council for Scientific and



Industrial Research, the Department of Agriculture for New South Wales and the Meat Inspection Branch of the Commonwealth Department of Markets and Transport.

So far as Australia is concerned, all caseous glands of sheep may be accepted for practical purposes as due to the Preisz-Nocard bacillus alone.

Young lambs prior to shearing are rarely affected. On badly affected properties, the older the sheep invariably the greater is the number affected. Neither climate nor locality in Australia seem to bear any relationship to the extent of the infection. Some properties in every State and district, so far as it is possible to ascertain, are entirely free of the disease; others are slightly infected, and a few are very seriously affected. The carrying capacity of the property has evidently no connection with the prevalence of the disease. Some properties carrying but one sheep to five acres are far more affected than others with several sheep to the acre. Subdivision and improvement of pastures, therefore, do not increase the risk. The nature of the feed does not seem to be important one way or the other. At one time there appeared to be some connection between grass seed infestation and the spread of the disease but, while contaminated grass seeds may undoubtedly convey the organism, further information and observations do not confirm this as a common factor in infection.

There is little evidence to suggest that natural infection is commonly caused by ingestion; it may occur through abrasions of the mouth at teething time, but the distribution of the lesions suggests that this is not a common method. Infection occurs most commonly from skin injuries.

In Patagonia, sheep have been depastured for only 60 years, and the majority of flocks are infected. Published results show that while young wethers are infected to the extent of over 5 per cent., the incidence in young ewes of the same age (18 months) is under 1 per cent. DESCAZEUX concluded that in Chilian Patagonia the operations of "marking," and especially of castration, are closely related to the spread of the disease. While tail and ear wounds of the ewe lamb are unlikely to come into contact with dirt or other contaminated material on the ground, the scrotal wound of the male lamb is very liable to infection. In Australia and New Zealand, however, there is no noticeable difference between the percentage of affected ewes and wethers of the same age and from the same flock. In Australia and New Zealand, "marking" of lambs is generally carried out in temporary yards, but in Patagonia it is usually conducted at the shearing sheds near the homestead.

All the evidence points to the shearing shed as the source of infection. The operations of gathering, driving and handling, tend to aid in the rupture of superficial abscesses and to spread the pus about, so that the wool and the floors of yards are often heavily infected. The comb of the shearing machine becomes infected with the consequence that each cut made in the course of shearing is inoculated with the organism.

Lambs should be shorn before the older sheep. The next year, after the lambs have been shorn, one-year-old sheep should be dealt with, and in succeeding years the sheep should be shorn in order of age.

The shearing shed should be given attention, the floors being cleaned and treated with disinfectant. Counting-out pens are often constructed underneath the shearing shed and get no sunlight which is in itself a powerful disinfectant. They should be cleaned and disinfected. The chute from the shearing sheds is often a source of contamination, as faeces collect at the bottom, and the sheep fresh from the shearer land in this and infect any cuts which have just been inflicted. When possible, yards should be damped down to prevent dust from flying about while the sheep are present. The time spent in pens should be reduced to a minimum.

The clipping machine should be thoroughly and repeatedly scrubbed with a rough brush in a strong solution of disinfectant and caustic soda. Soon after shearing, the sheep should be carefully examined when possible (this cannot be done as conveniently at other times), and infected animals should be separated from the flock.

The advisability of dipping after shearing in a non-poisonous, non-arsenical dip, is under consideration.

While no satisfactory vaccine against the disease is available, artificial immunisation is being studied.

At present it is impossible to certify that any live sheep is free from infection, but the subject is being investigated.

MENCK, Fr. (1930.) Die Diagnose des *Streptococcus agalactiæ* (mastitidis) unter besonderer Berücksichtigung der Lackmuskmilch, sowie eine neue Methode zur Herstellung von Blutagarplatten. [The Diagnosis of *Streptococcus agalactiæ* (mastitidis) with special reference to Litmus milk, and a new method of preparing blood agar plates.] *Berl. Tier. Woch.* 46. 461-464. [19 refs.]

The author refers at some length to the views held regarding the methods that should be adopted for the differential recognition of *Streptococcus agalactiæ* and *Streptococcus lacticus*. In his own view, litmus milk is a valuable medium for this purpose. The method of preparing the medium which he advises is as follows:—whole milk is boiled, and then brought to neutrality; to this is added a 7 per cent. solution of litmus (Kubel and Tiemann), and the milk is distributed to tubes in 5 c.c. quantities. The tubes are then autoclaved at 110° C. for ten minutes. In the course of his experiments, the author found it preferable to use a 10 per cent. solution of litmus, as it produces a more intense red colour.

He is of the opinion that the objections that have been raised to the use of litmus milk for the purpose in question are ill founded. It has been objected that the medium is unsuitable for systematic testing on account of the long period of incubation required. He finds that, for the recognition of the two types of streptococci, the observation need not be prolonged beyond one day.

The blood agar plates which have been used by the author for the cultivation of the streptococci contain 3 per cent. of whole guinea-pig blood. Experiments have been made with defibrinated and with whole blood from the horse, ox, sheep, rabbit and guinea-pig, and it has not been possible to detect any difference.

Summing up, the author finds that the *Streptococcus agalactiæ* produces red coloration in litmus milk in 24 hours. With prolonged incubation clotting occurs and, subsequently, decolorisation. The *Streptococcus lacticus* produces decolorisation and clotting within 24 hours and, in some cases, this is preceded by reddening which begins at the top and extends downwards.

These results made it quite unnecessary to prolong the period of observation to seven days. Other means which serve a valuable purpose after the strains have been purified on blood agar plates are:—Trommsdorff test, the determination of the chlorides, broth, and growth in methylene-blue milk.

SEDDON, H. R., and EDGAR, G. (1930.) Disease Conditions Associated with Anærobie Bacteria, and the Manner of their Causation. *Austral. Vet. Jl.* 6. 98-104.

A general review of the habitat and pathogenicity of the anærobie disease-producing bacteria with brief mention of certain organisms which in themselves are not pathogenic. The distribution in nature of the important members of the group is discussed, and the authors' investigations on the subject are included. *B. welchii* was found in all the samples of New South Wales soils, and also in the fæces of 20 animals, mostly sheep, which were examined. *B. botulinus* was found in 7 per cent. of the soils of New South Wales. The incidence was highest in cultivated land, and the bacillus was absent from twelve samples of virgin soil. *B. œdematiens* was found in 12 per cent. of 26 soils not grossly contaminated with fæcal material, and in 48 per cent. of 19 grossly contaminated soils (dairy yards). It was absent from four samples of virgin soil. The organism was present in six out of ten samples from "black disease" land. *Vibrio septique* was found in 20 per cent. of 45 samples, being commonest in cultivated land, and soil liable to fæcal contamination. It was absent from virgin land. *B. tetani* was present in 9 per cent. of 45 samples, was commonest in cultivated land, and absent from virgin soil.

Although *B. chauvæi* is usually considered to have its natural habitat in the soil of damp, marshy areas, it has never been isolated from such soil. It is probably not widely distributed in the soil like *B. tetani*, but is presumably comparatively localised and, on properties where blackleg is enzootic, the disintegration of carcasses of animals dead of the disease has probably much to do with the continuance of infection, since the organism is one which does not appear to be associated with ordinary decomposition changes in organic matter. The incidence of *B. necrophorus* in soil does not appear to have been investigated.

The biology of soils rich in organic matter is discussed, and the rôle of anærobes in relation to disease is given considerable attention. *B. welchii* is the cause of a braxy-like disease in Western



Australia. The authors have not found *B. œdematiens* in "swelled head" of merino rams, as BULL (1928) described, but in similar cases they have found *B. chauvœi*. They suggest that in "blackleg," as in "black disease," spores may remain in normal tissue until local conditions are favourable for their multiplication, and that possibly there is some devitalising influence in the muscles allowing of propagation of the organism and development of the disease. They point out the analogy of azoturia with its degeneration of voluntary muscle, and hæmoglobinæmia. On a property affected with "blackleg," they observed that sheep were affected with a form of hæmoglobinæmia due to a plant having photosensitising properties and, though no cases of photosensitisation were seen in the sheep in which "blackleg" occurred, these sheep must certainly have had access to the plant. There were also cases of true "swelled head" on the property at the same time. In many of the cases of "blackleg" the swelling involved the head.

An account is given of the influence of aerobes and of non-pathogenic anærobes on pathogenic bacteria.

DESCOMBEY, P. (1930.) Sur une technique de production de l'antitoxine tétanique et ses résultats. [A Technique for the Production of Tetanus Antitoxin and its Results.] *Ann. Inst. Pasteur.* 45. 373-375.

After several years of experimental investigation the following standard method of immunisation for the production of tetanus antitoxin has been evolved.

Using anatoxin and tetanus toxin of good antigenic power (a minimum of six to eight antigenic units), weekly subcutaneous injections are given, beginning with 20 c.c. of anatoxin with tapioca, and increasing steadily up to 200 c.c. at the fourth injection following. Then a beginning is made with 250 c.c. of toxin plus tapioca and weekly increasing doses are given up to 500 c.c. at the third injection following. Ten days later the animal is bled.

Rather more than thirty horses have been immunised in this way, and their sera have been found to contain from a minimum of 250 to more than 2,000 international antitoxic units.

For comparison the author gives a summary of the results obtained in 1923 with 96 horses immunised by the older method. Twelve animals yielded a maximum of 150 international units, and all the others yielded sera of lower value. Forty-one sera were of values below 25 units.

Special mention is made of the fact that the horses used for immunisation were obtained from the army and that some of them had been given two 10 c.c. injections of tetanus anatoxin. These animals were able to react markedly to subsequent injections of anatoxin in that the production of antitoxin was considerably augmented.

TURNER, A. W. (1930.) **Black Disease (Infectious Necrotic Hepatitis) of Sheep in Australia.** *Bull. No. 46. Council Sci. & Indust. Res. Australia.* 139 pp. 50 Figs. and 2 Maps. [140 refs.]

A sub-title is "A Toxæmia induced by a Specific Bacterium (*B. œdematiens*) in Hepatic Lesions resulting from the Migrations of young Liver Flukes. (*F. hepatica*)."

Dr. Gilruth, Chief of the Division of Animal Health of the Council for Scientific and Industrial Research, contributes a foreword.

The heaviest losses in the wool industry of Australia due to sheep diseases are caused by worm parasites and blow flies, and by "braxy-like diseases." "Braxy-like diseases" are characterised by a predilection for the best-conditioned animals, a high mortality with few or no premonitory symptoms, rapid decomposition after death, and a definite seasonal incidence. They all appear to be related to the presence of anærobes. As far as is known, "braxy" does not occur in Australia, but four diseases of the type are known to exist: (a) "Beverley disease" of Western Australia; (b) "braxy-like" disease of South Australia; (c) "braxy-like" disease of Tasmania; and (d) "black disease" of Victoria and New South Wales.

Oxer has recently shown that the Tasmanian disease is "black disease," and Turner considers that, eventually, one other disease of the "braxy" type may be found in Australia, but that it will be found to be different from European "braxy" or "bradsot."

THE DISEASE.—"Black disease" is an acute infectious disease of sheep and sometimes of bovines,

caused by localised infection of the liver, in areas of necrosis, with *B. œdematiens*, usually alone, but in some cases associated with certain other anærobes, and apparently always associated with invasion of the liver by immature liver flukes. The name is probably derived from the colour of the dried skins taken from the carcasses. The name, infectious necrotic hepatitis, has been officially adopted by the Victorian Department of Agriculture by an Order in Council, and the disease is gazetted as notifiable. DODD considered that the disease had been in existence for about 60 years in New South Wales. Its incidence has risen recently. The author discusses, in great detail, the history of the infection, its distribution, the type of country and of sheep management related to its incidence, the clinical description especially as illustrated by close observation of 14 cases, the *post-mortem* appearances, the histological changes, the bacteriological findings, and differential diagnosis.

*B. œdematiens*. He describes the technique he found suitable for his work, and gives an elaborate account of the morphological, cultural, biochemical, pathological and immunological characters of the organism. He demonstrated the immunological identity of the bacillus with typical human strains and also that it was distinct from the pathologically similar *B. sordellii* or *B. hemolyticus*. On a comparison of human and ovine strains of *B. œdematiens* there were no great differences except in size and, possibly, the fermentation of glycerine. Apparently, size is a factor of no great specific importance and may vary with the environment.

THE RÔLE OF THE KATAPHYLACTIC AGENT OR ACCESSORY FACTOR, *Fasciola Hepatica*.—Following up the work of DODD, the author undertook an experimental study of this aspect of the infection. He had previously shown that, after intravenous or intratracheal injection of toxin-free spores, rabbits became carriers of latent spores in the liver, spleen, and bone marrow. On the assumption that such a state of latency exists in nature, and that sheep on infected pastures absorb spores into their bodies by some means, the hypothesis was formed that, spores existent in the liver in a latent state, are enabled to germinate owing to the localised necrosis caused by the presence of wandering immature flukes. He describes results obtained in the course of his investigations which provide evidence in support of this theory. He found also that it was possible to produce artificial liver infections very closely approximating to "black disease," by the use of toxin-free spores and liver irritants such as calcium ions. Similar cases were produced from the action of toxin-free spores and *Cysticercus pisiformis*.

IMMUNITY.—Toxin was produced by growing the organism in meat-liver broth based on the formulæ of STICKEL and MAYER (1918), and of WEINBERG and GOY (1924). The inoculated flasks were incubated at 37° C. for 48 hours, formalised by the addition of 0.4 per cent. of commercial formalin (kept neutral by the inclusion of excess of magnesium carbonate in the stock bottle), closed with sterile rubber stoppers, and incubated for a further ten days. Meanwhile a test of the toxin concentration was carried out with samples removed before the formalin was added, because it was found that the antigenic values of anatoxins are related to their toxin content previous to formalisation.

It was found that retention of the bacterial bodies probably added to the immunising value of the product. The results of field trials are reported.

METHODS OF CONTROL.—The author gives a summary of the whole available evidence, showing that the necessary measures are immunisation of the stock and the utilisation of means for the control of the liver fluke.

The bulletin is well produced, and contains a graph showing the rainfall and the monthly incidence of mortality from "black disease" on certain farms. There are 50 excellent figures, mostly photographs and photomicrographs, illustrating various aspects of the problem, and there is a map of South Eastern Australia and Tasmania, showing the distribution of *F. hepatica* and "black disease."

SORDELLI, A., and FERRARI, J. (1930.) Dissociation du *Vibrien septique*. (*Dissociation of Vibrien Septique*.) *C.R. Soc. Biol.* 105. 245-246.

The authors found dissociation in *Vibrien septique* in a purely accidental manner in the course of studies with glucose broth and liver extract culture media they used in their work on anærobes. The strain, which had been maintained in subcultures for ten years, had been passed through guinea-pigs to raise its virulence, and the last passage had taken place two years previously. On 48-hours' old subcultures on glucose liver agar, they noted two types of colony:—(a) opaque round colonies with



irregular, but well circumscribed borders; and (b) transparent amœboid colonies with smooth borders, the former type predominating. The bacilli of the (a) type of colony showed the characteristic forms of *Vibrio septique*. The majority of the bacilli of the (b) type of colony were spindle-shaped, of about the same size as *Vibrio septique*, but somewhat thicker at the centre and weakly Gram-positive. Both forms were pathogenic for guinea-pigs, and produced characteristic lesions. Both types preserved their morphological differences through many generations of subcultures.

NIEMANN, K. W. (1930.) *Clostridium welchii* Infection in the Domesticated Fowl. *Jl. Amer. Vet. Med. Ass.* 77. 604-606.

The author examined six birds from a flock of 600 in which 100 had died.

He isolated a bacillus with the characters of *Cl. welchii* which was found to be virulent when inoculated into guinea-pigs and chickens. Fowls fed on cultures of this organism remained healthy and, after maintenance in the laboratory for eleven months, 2 c.c. of a ten-hour sub-culture given intravenously was not pathogenic for healthy birds. The organism which was recovered from dead birds was identified as *Cl. welchii* by its biological characters; it was capable of producing disease by inoculation and was recovered from the test birds. Infection appears to occur from the alimentary tract, and disease is only caused when the infection is very heavy.

ROBINSON, E. M. (1930.) *The Bacteria of the Clostridium botulinum C and D types.* 16th Rept. Direct. Vet. Ser. & Anim. Indust., Union S. Africa. pp. 107-141. [41 refs.] Pretoria: Govt. Printer.

In an introductory part of this paper the author summarises the literature dealing with the two types of organism referred to in the title. The comparison between them is then dealt with in detail under four headings: morphological and cultural characters, toxicity for different species of animals, cross agglutination tests and toxin-antitoxin tests. It is impossible to deal in an abstract with the details given under the first of these headings, but they are conveniently tabulated by the author. In this table the organisms included for comparison are: *Cl. botulinum* A (Type A223, Lister Institute), *Cl. botulinum* B (Type B95, Lister Institute), *Cl. botulinum* C (Graham), *B. paratubulinus* (Seddon), *Cl. botulinum* D (Theiler and Robinson, formerly *Cl. paratubulinus bovis*), *Cl. botulinum* C (equine type, formerly *Cl. paratubulinus equi*), and *Cl. botulinum* 334 (a type probably identical with C).

The section dealing with the comparative toxicity for different species of animals is very short and contains little more than references to the literature. Reference is made to the important point that toxicity tests must be carried out with recently isolated cultures, as the toxicity is likely to fall off even when constant subculturing is carried out. In the earlier stages of the comparative agglutination tests, difficulty was experienced in immunising rabbits because of the difficulty of rendering the cultures non-toxic, but the difficulty was eventually overcome by formalising (0.4 per cent.) cultures obtained by the diffusion shell method.

In the later tests goats were used for the production of antisera because there was less risk of loss from intercurrent infections; they yielded anti-sera of good quality, and large quantities could be obtained. Such sera remained effective for at least six months in cold storage.

For the agglutination tests the rapid glass plate method of HUDDLESON was used because the "C" type of organism tends to clump and settle out by itself. The dilutions used were 1 in 25 to 1 in 3,200 and upwards to the extent necessary to reach the end point. The emulsion was of such density that the loop disappeared at 4 mm. on the Gates nephelometer, and 12 per cent. sodium chloride was used as the suspending medium. The result should be read when the plate has been heated to blood heat over the flame, and again after 15 minutes.

The results of the various cross tests are given in 15 tabular statements. The author finds that there is a definite group relationship between certain of the types. The close relationship of *Cl. botulinum* C (Graham) and *Cl. botulinum* C (equi) is shown, as well as that of *Cl. botulinum* (334) to the other two as demonstrated by toxin-antitoxin tests. Probably toxin-antitoxin tests form the best means of classification, but non-toxic types must of course be differentiated by other means.

There were available for the tests the pure cultures already referred to and a number of toxins

derived from mixed bacterial cultures ; and seven lots of antitoxin were at hand which were prepared, with the exception of two which were obtained from Parke, Davis and Co. (combined A and B), and Graham (C), by the immunisation of goats. The process of immunisation was begun with a succession of doses of anatoxin, and completed with progressive doses of toxin. The final dose of the latter was 2,000 M.L.D. The serum in a 1 c.c. dose would then neutralise about 500 M.L.D. for the guinea-pig.

The various tests employed are shown in 21 tables, which are summarised in one tabular statement.

It appears to be certain that at least four types of *Cl. botulinum* occur in nature. The organism described by THEILER and ROBINSON as *Cl. paratobotulinum equi* appears certainly to be identical with the C type of BENGSTON and of GRAHAM, but it is very much more toxic for horses than the American type. *Cl. paratobotulinum bovis* is certainly "*Cl. botulinum* D."

Emphasis is laid on the fact that organisms of the C type occur on "lamziekte" farms, and that condition can no longer be held to be due to one particular type of toxin.

PIJOAN, M. (1931.) **The Action of Testicle, Kidney and Spleen Extracts on the Infective Power of Bacteria.** *Jl. Exp. Med.* **53.** 37-42.

LEDINGHAM and BARRATT applied the name Reynals' factor to a substance described by DURAN-REYNALS which occurs in various organs of the bodies of animals. It is present in greatest concentration in the testes and in smaller amounts in the kidneys, skin, brain and placenta, and is present in the supernatant fluid after centrifugation of suspensions of these organs.

The author tested the action of Reynals' factor on the course of bacterial infections by injecting it into mice and rats along with cultures of each of the following organisms :—" *E. typhi*, *B. dysenteriae* (three strains), *B. paratyphus A*, *B. paratyphus B*, *Proteus* (two strains), *cholera*, *enterococcus*, *enteritidis*, *tetrigenus*, *B. prodigiosus*, *S. rosea*, *Str. erysipelas*, *pneumo-cocci*, *E. coli* (two strains) and *B. violaceus*." [Quotation only to the extent of using author's nomenclature.]

Reynals' factor considerably enhanced the pathogenic action of these bacteria. The kidney extract possessed this action but not to the same extent as the testicular extract. Spleen extract never enhanced the action of the bacteria, and in some cases even weakened it.

NYE, Robert N., and PARKER, Jun., Frederic. (1930.) **Tissue Reactions in Rabbits following Intravenous Injection of Bacteria.** *Amer. Jl. Path.* **6.** 381-400. 1 table, 20 plates. [43 refs.]

The authors carried out experiments in which relatively large doses of dead bacteria were injected intravenously into rabbits, and they describe the resulting tissue changes studied. The tissue changes were first reported by NYE and co-workers as resulting from repeated injections of non-hæmolytic streptococci. The present experiments were carried out to test the view that the changes were specific to the organism used, and a number of different bacteria, living and dead, and colloidal substances, were injected in different ways. The results showed that the tissue changes are not specific, but represent the reaction of the animal in disposing of foreign materials in the blood stream. The removal takes place mainly in the sinusoids of the liver and spleen and in, or about, the capillary network of the lungs. The process of phagocytosis stimulates the production of cells resembling lymphoid cells which apparently are converted into monocytes and giant cells. Apart from the places mentioned, giant cells of the Langhans type may be found in bone marrow, glomeruli of the kidney, and the cortex of the adrenal. The distribution and durability of the lesions vary with the organisms or other material injected. The reactions appear to have nothing to do with sensitization or immunisation.

BEMELMANS, E. (1930.) Die "Kommensale" Infektion. Ihre Rolle bei ansteckenden Krankheiten, deren Aetiologie noch ungeklärt ist (Grippe, Brustseuche, und Hundestaupe). [**"Commensal" Infection. The Part it Plays in Contagious Diseases the Cause of which has not yet been Determined.**] *Berl. Tier. Woch.* **46.** 629-634. [34 refs.]



By "commensal" infection the author means infection of the body by means of organisms which ordinarily do not invade it, but which, when for some reason the power of resistance of the body is depressed, gain access to it and set up disease. He considers streptococci, staphylococci, and the colon bacillus as the most important examples.

Protection against commensal infection is of the greatest importance in young children, and this is provided for in nature by passive immunity acquired prior to birth.

The outbreaks of catarrhal fever or pneumonia that occur in young horses when brought into stables are, in the author's opinion, cases of commensal infection. His observations lead him to think that they are not caused by obligatory parasites, because he has seen outbreaks occur in stables in which there has been no case of catarrhal fever or pneumonia for many years. Insufficient nourishment has been shown to be a cause of commensal infection in experiments connected with avitaminosis. Defective regulation of the heat of the body is another cause. Disease is, however, the most frequent factor in the causation of commensal infection, as, for example, infection of pigs with paratyphoid B when suffering from swine fever.

The author states that commensal infection can form the starting point for obligatory infection, and quotes an experiment by HEUSER in which mice were made ill by feeding upon a diet of pure egg albumen, and then mixed with normal mice. A paratyphoid B. outbreak occurred among them. He also states that commensal organisms may have their virulence raised by passage and produce parasitic infection [*i.e.*, change into primary disease-producing organisms].

DAVIES, G. O., and TORRANCE, H. L. (1930.) **Observations regarding the Etiology of Actinomycosis in Cattle and Swine.** *Jl. Comp. Path. & Ther.* **43.** 216-233. [1 table.]

The authors describe their findings in the examination of lesions from 20 consecutive cases detected among imported Irish cattle, and from one pig. Their results agree with those of other investigators that two distinct conditions exist, namely, actinomycosis and actinobacillosis. In particular they confirm the finding that the lesion of the tongue commonly referred to as actinomycosis is invariably actinobacillosis. Lesions caused by the actinobacillus in the internal organs and glands bear a very close resemblance to those of tuberculosis. The importance of this point is emphasised by the authors as having bearing upon the procedure in meat inspection.

The one case occurring in a pig was one of true actinomycosis of the udder. The authors employed the agglutination test in order to confirm their diagnosis, and by its means they were able to show that all their strains were serologically identical.

## IMMUNITY.

FLEISCHHAUER, G. (1930.) Ueber die Verwendung von Chinosol bei der Antigenherstellung. [**The Use of Chinosol in the Preparation of Antigen.**] *Zll. f. Bakt. (Orig.).* **115.** 480.

The preserving properties of chinosol were studied by the author, who found that it was suitable for the preservation of abortion antigen and of hæmolytic amboceptor, and that its use did not interfere with the complement fixation reaction.

SCHMIDT, S. (1930.) Toxines et antitoxines. Constitution et mode d'union. [**Toxines and Antitoxines. Constitution and Mode of Union.**] *Ann. Inst. Pasteur.* **45.** 337-372.

This paper is in the nature of a general survey of the subject of toxins and antitoxins beginning with the discovery by ROUX and YERSIN of diphtheria toxin in 1887 and leading up to the work of RAMON in connection with standardisation by flocculation. No personal work appears to be included in it.

ANTHADSE, V. (1930.) Action antagoniste de l'alexine vis-à-vis du phénomène de l'agglutination. Son mécanisme. Sa valeur comme preuve de l'unicité des anticorps bactériens. [**The Antagonistic action of Alexin as regards the Phenomenon of Agglutination. Its Mechanism. Its Value as Proof of the Unicity of Bacterial Antibodies.**] *Ann. Inst. Pasteur.* **45.** 203-220.

The author has frequently observed when carrying out agglutination tests with fresh serum that,

in a series, the reaction is more pronounced in the tubes which contain smaller quantities of serum. This is the so-called paradoxical reaction. He rejects the explanations which have hitherto been put forward to account for this phenomenon. In his opinion complement plays some part in producing this type of result. He has noted that, in carrying out Widal tests, the tubes containing the larger quantities of serum mixed with emulsion, may become clear without agglutination taking place. This action is clearly a bacteriolytic one. He also finds that the noxious action of normal saline, which is not isotonic for bacteria, is hindered by the presence of serum due to the formation of a colloidal protective covering over the organisms. In the tubes of a series in which the proportion of serum is progressively smaller, this protective layer is not formed in those towards the end containing the smaller amounts, and normal saline kills the organisms in the suspension.

The part played by complement in these phenomena is established by the fact that heating the serum to 56° C. for half an hour prior to performing a Widal test, allows one to get agglutination in all the tubes where, prior to heating, the emulsion cleared as a result of bacteriolysis. In these tests a very weak suspension of organisms was used, namely, 250 million per c.c.

It seemed advisable that tests should be carried out to determine the part played by a variable concentration of antigen in the presence of a fixed amount of antibody. Three emulsions were therefore prepared containing 2,000 million, 800 million, and 40 million bacteria per c.c. Series of tubes with fresh and with inactivated sera were put up containing dilutions from 1 : 40 to 1 : 1,000. The dilutions were made by adding 0.5 c.c. of serum previously diluted to the required extent to 0.5 c.c. of the various emulsions. The results are set out in schematic form, and they are summarised as follows :—

1. None of the fresh sera gave the maximum reaction with the highest concentrations with any of the emulsions.

2. In the tubes containing the strong and medium emulsions the reactions increased up to the dilutions 1 : 120 and 1 : 480, and then decreased again.

3. With the weak emulsion, agglutination only began at the tubes 1 : 120 to 1 : 480, and then decreased. The clearing of the first tubes could be shown, by cultural testing, to be due to bacteriolysis and not to agglutination.

4. A certain amount of clearing, due to bacteriolysis, occurred in the first two or three tubes.

5. No clearing, due to bacteriolysis, could be observed with the naked eye, but there was what the author calls blockage of the agglutinating action. The antibodies present were deviated by the complement towards a lytic action.

6. Heated (inactivated) sera produce the maximum agglutination in the first tubes of the series irrespective of the density of the emulsion, and this steadily declines. There is, therefore, a direct relationship between the amount of serum present and the degree of agglutination. With the idea of investigating the anti-agglutinating action of complement, the author carried out cross tests with (1) fresh serum, (2) inactivated serum, (3) inactivated serum to which heterogenous complement had been added, and (4) the same serum as (3) with the exception that its complement had been made good in the tubes of the series in which it had disappeared as a result of the dilution. It was found that the opposition of alexin to agglutination lies in the fact that, while sufficient alexin is present, bacteriolysis occurs, but when, as the result of dilution of the serum, the amount of alexin falls below the minimal effective amount, agglutination occurs. This phenomenon affords support to the view that only a single microbial antibody occurs.

The author condemns the use of dilutions of 1 : 25 to 1 : 200 with weak emulsions for the purpose of the agglutination test, and he holds that all sera used should be inactivated by heating to 56° C. for half an hour.

#### DISEASES CAUSED BY PROTOZOAN PARASITES.

WHITWORTH, S. H. (1930.) **Redwater, Anaplasmosis, and Gonderia mutans.** *Ann. Rpt. Dep. Agric., Kenya.* p. 287. Nairobi : Govt. Printer. [8vo.]

The author records that, when splenectomy was performed, breakdowns to infection occurred in five animals which had recovered from redwater and anaplasmosis. In six animals infected with *Gonderia mutans*, a similar result was obtained. In these cases the parasites were present in the blood in such numbers that the picture closely resembled that presented by East Coast Fever blood. No



Koch's bodies were observed although gland smears were examined daily over a considerable period. Koch's bodies have not as yet been observed in Kenya in cases of *Gonderia mutans* infection and, consequently, the view expressed by THEILER and GRAF (13th and 14th Annual Reports, Onderstepoort), that *Gonderia* is in reality *Theileria*, lacks confirmation.

WHITWORTH, S. H. (1930.) **East Coast Fever.** *Ann. Rpt. Dept. Agric., Kenya.* pp. 224-239. Nairobi: Govt. Printer. [8vo.]

The points investigated were :-(a) The artificial transmission of East Coast Fever and immunisation; (b) the efficacy of dipping and hand dressing of susceptible animals in controlling the disease in a "highly susceptible camp."

Experiments in immunisation were carried out by :-(1) Injecting spleen pulp taken on the second day after the first rise of temperature, followed a week later by a second inoculation of material taken during the late stages of reaction, *i.e.*, just before death occurred. (2) Injecting spleen pulp taken late in the reaction only.

Under No. 1 a number of animals gave clear reactions to the second inoculation, and some of the animals subsequently survived exposure to infection.

Under No. 2, nine animals were used; eight reacted upon exposure to infection, and seven died.

A repetition of tests upon similar lines yielded varying and unsatisfactory results. In the past, spleen inoculations have given the best results as regards protection when the material used has been rich in Koch's bodies and *Theileria parva*. The indications of the present experiments are that the double inoculation is possibly superior to the single inoculation.

The suggestion is put forward that there is some particular stage of the parasite which enables experimental inoculation to succeed.

**DIPPING AND HAND-DRESSING EXPERIMENTS.**—The object of the experiments was to determine whether cattle could remain in a highly infected camp for periods up to 72 hours without becoming infected, and whether they would remain free from infection if they were dipped and hand-dressed immediately after removal from the camp.

The hand-dressing mixture was an emulsion of hard soap (1 lb.), soft water (1 gallon), and paraffin (4 gallons); this mixture, which is an 80 per cent. stock emulsion, was diluted to make a 30 per cent. emulsion. The fluid in the dipping tank was 12 per cent. above normal three-day strength.

Two small batches of animals were used in the experiments. Six animals which had been dipped and hand-dressed prior to exposure for periods of 59, 65 and 71 hours (two for each interval), and three animals which had not been dipped, were exposed for the same periods.

Of the batch of six, two were found to be immune, two died of the disease, one failed to become infected, and one became infected, and recovered. The three in the other batch all became infected, and died.

It was clear that the dipping and hand-dressing at the end of the periods of exposure was not completely effective, as the minimum period of feeding for an infected tick to transmit the disease is 72 hours.

During the process of dipping and hand-dressing which was carried out every three days subsequent to exposure, it was noted that living ticks were present on all the animals for several days after exposure.

ROBINSON, E. M. (1930.) **A Note on the Serological Diagnosis of *Trypanosoma congolense* Infection.** *16th Rpt. Direct. Vet. Ser. & Anim. Indust. Union of S. Africa.* pp. 61-65. Govt. Printer: Pretoria.

Systematic tests have been carried out on 20 animals inoculated either with Zululand or Rhodesian *T. congolense* or with both.

The following are the essential features of the complement fixation test used. The hæmolytic system was rabbit anti-sheep. All sera tested were heated at 60° C. for half an hour, and it was found that only in rare instances did sera so treated give non-specific reactions.

The antigen is prepared by bleeding guinea-pigs or rats out into 1 per cent. sodium citrate in normal saline, using equal parts of blood and citrate solution. Formalin is added in the proportion of 1 in 1,000. The trypanosomes are promptly killed. This was found to be a satisfactory method of obtaining trypanosomes by centrifuging, as it caused detachment of the parasites from the corpuscles. On centrifuging in tubes about  $\frac{1}{4}$  in. in diameter, a good layer of trypanosomes is obtained. The trypanosome layers are collected into one tube, and saline is added to make a 50 per cent. suspension. The suspensions are recentrifuged and the trypanosome layers collected. Preservative, as described by WATSON, namely, 10 per cent. glycerine and normal saline mixture plus 0.1 per cent. formalin, is added in the proportion of two parts to one of suspension. Of this mixture, 0.2 to 0.5 c.c. is sufficient for 15 to 20 tests. The strain used was one obtained from Rhodesia. The laboratory strain had been running in guinea-pigs for eight years and, while still virulent for guinea-pigs, had fallen off in virulence for cattle. This strain never produced sufficiently heavy infections in guinea-pigs to permit of the preparation of an efficient antigen from it.

Some of the animals tested by this method were under treatment with antimosan. A line or two of description is given for each animal indicating the relationship between the reactions and the animal's condition, and a tabular statement gives the details of the tests.

It has not been found possible, in the diagnosis of *T. congolense* infections, to obtain the clear-cut results obtainable in the case of dourine. A time limit has to be set for the reaction, and it is instanced that a reaction which is definitely positive at half an hour at 37° C., may pass to partial hæmolysis in an hour. It is suggested that this may mean that the combination of antigen and antibody is not strong, and it would seem that *T. congolense* does not cause the production of antibodies to the extent that *T. equiperdum* or *T. brucei* do.

The method may be of service in the field when other methods of diagnosis fail, and it can also be used as an indicator of success or failure in treatment.

PARKIN, B. S., and HORNBY, H. E. (1930.) **A Contribution to the Study of "Immunity" in Bovine Trypanosomiasis.** 16th Rpt. Direct. Vet. Ser. & Anim. Indust., Union of S. Africa. pp. 11-20. Pretoria: Govt. Printer.

In this paper the authors record some observations connected with immunisation against trypanosomiasis which were made in the course of experiments planned for a different purpose. The observations expose the weak points of existing schemes of immunisation, but may yet contribute towards their ultimate successful development.

During the last decade, attempts have been made to foster and improve local races of naturally immune cattle as a means of keeping some control over trypanosomiasis and, possibly the lack of success attending efforts to provide a practical method of artificial immunisation, has played some part in stimulating this line of investigation. The possibility that the development of such means of immunisation might complicate rather than solve the problem, may have been overlooked because the immunity would probably be bound up with the persistence of the parasite in the host.

The authors prefer to adopt the French term "premunition" for that state of resistance to infection which is probably dependent upon the persistence of the parasite in the host, and to reserve the term "immunity" for that condition in which the host is absolutely resistant to the invasion of the parasite.

The two important species of trypanosome, as far as cattle in Africa are concerned, are *T. congolense* and *T. vivax*. It does not appear to be possible to produce immunity by artificial means, and therefore one must, for the time being, aim at producing premunition. Further, the condition caused by *T. vivax* is less severe and more easily treated than that caused by *T. congolense*, and it is probable that a method successful against *T. congolense* would also prove successful against *T. vivax*.

Untreated cases of *congolense* infection, kept under favourable conditions, run a chronic course characterised by unthriftiness, rapid pulse, and irregular hyperthermia. The degree of advancement of the disease can best be judged by a blood count. It has been found that the disease, apart from the febrile reaction, is a pure anæmia such as results from the withdrawal of blood. There are, however, none of the corpuscular changes in the red blood corpuscles which usually make their appearance in cases of anæmia. The normal count of the animals under experiment was eight to ten million per c.mm., and it was found that no loss of condition occurred until the count fell to about half the normal. When that occurred, nothing could be done to prevent loss of condition.



The skin became dry and scurfy, and there was acceleration of the pulse to counterbalance the loss of hæmoglobin, but the visible mucous membranes did not furnish evidence of the severe anæmia.

The majority of cattle possess a considerable resistance to *T. congolense* as is shown by the fact that in most cases the disease runs a chronic course when they are kept under favourable conditions.

The authors found that the administration of a trypanocidal drug to a chronic case was usually sufficient to convert the condition into one of premunition. They did not find it necessary to "time" their injections as advised by Bevan. It was essential, of course, that the treatment should not be pushed so as to produce complete sterilisation.

There is no sharp line between the state of chronic infection and that of premunition, but there is no doubt that the conditions under which animals are kept play a most important part in determining whether an animal on the border-line shall progress to chronic and ultimately fatal infection, or recover to maintain a condition of premunition.

In tests designed to ascertain the value of the premunition established, it was found that, while premunition was completely effective against the strain with which it was produced, it was non-effective against a different strain. In the experiments the premunition was achieved with a Zululand strain, and the heterologous test was carried out with a Rhodesian strain.

"Adhesion tests" carried out with plasma and serum showed that the premunised animals gave positive results with the Zululand strain, and negative results with the Rhodesian strain until four weeks after the test inoculation with that strain, when the reaction became positive. Negative controls gave negative results in every case.

It was observed that, in premunised animals with a low blood count, there was an increase in the count for four weeks after inoculation with the Rhodesian strain, indicating a continuance in recovery from the Zululand strain, and in premunised animals with a high count, the reduction was slower than in the controls.

Thus it is seen that premunisation is specific for the strain used, but it also appears that premunisation against one strain lessens the dangers of anæmia produced by another. It is in this way that small herds of cattle can survive in fly belts, but if these animals were exposed to infection elsewhere their resistance would break down.

DAUBNEY, R. (1930.) **Trypanosomiasis. Experimental Treatment.** *Ann. Rpt., Dept. Agric., Kenya.* p. 298. Nairobi: Govt. Printer. [8vo.]

During the year some experiments have been carried out with antimosan, and it is hoped that records will become available to show the value of this drug as compared with antimony tartrate. No details of any tests or experiments are given.

PARKIN, B. S. (1930.) **A Study of Bovine Trypanosomiasis.** *16th Rpt. Direct. Vet. Res. & Anim. Indust., Union of S. Africa.* pp. 21-53. Pretoria: Govt. Printer.

The work described in this paper grew out of experiments primarily intended to investigate the possibility of devising some treatment for bovine trypanosomiasis which would remove the defects of Curson's tartar emetic treatment. The aims were :-(a) that the treatment should be easy of administration; (b) that it should be effective against *T. congolense*, and to a less extent against *T. vivax* and *T. brucei*; (c) that it should not be prohibitive in cost.

The main objection to the tartar emetic treatment is the necessity of giving the drug by the intravenous route. Its advantages are its efficacy against *T. congolense* and its cheapness.

Attention was directed to other compounds of antimony, and the proprietary drug antimosan was selected for trial. The author refers to previous tests carried out by CURSON and others with antimosan.

This preparation has the advantages that it can be injected subcutaneously without fear of unfavourable local effects, and fewer injections are necessary to produce sterilisation or premunition. The animals to be injected can be dealt with in a "crush" with the minimum amount of handling and with speed.

Tests were made with 25 c.c. doses of a 12 per cent. solution and with 40 c.c. doses of a 7 per cent. solution. While the smaller dose of the more concentrated solution has some advantages, the use

of the 7 per cent. solution is indicated for field work. It is noted that in horses the 12 per cent. solution caused serious damage to the tissues at times. The cost of the treatment which the author recommends for maintaining in health an animal exposed to infection more or less continuously, works out at about ten shillings per annum. This is rather prohibitive.

Five bovines were infected with *T. vivax*, but unfortunately piroplasmosis and anaplasmosis were transmitted at the same time and there was resulting loss of condition. Treatment had to be given for them. One of the animals died. One was kept as a control, and the other three were treated. All three apparently made complete recoveries. Two systems of treatment were tried for *T. congolense* infections: (1) Short Interval; and (2) Long Interval.

In the short interval treatment it was found that subcutaneous injections of 3 g. repeated twice and five times at intervals of eight days produced sterilisation, while five injections of 1.2 g. at intervals of eight and four days failed to produce sterilisation. Two injections of 3 g. at a week's interval were successful in two cases out of five.

It was not found possible to sterilise by means of a single dose of 6 g. In two cases out of three, this treatment failed, as did also treatment involving two doses each of 3 g. on consecutive days.

While these experiments were being carried out, "long interval" tests were also being made and, as these appeared to be more promising, the short interval tests were brought to an end.

As premunisation, and not complete destruction of trypanosomes was to be aimed at, and as cost was a prime consideration, it was decided to start experiments in which doses would be given at long intervals. It was considered as a possibility that by long interval dosage there might be less chance of the trypanosomes becoming drug-fast.

In a preliminary experiment, four doses of 3 g. at intervals of four weeks were found to sterilise. The dose per kg. body-weight ranged from 0.006 to 0.021 g. The animals receiving the smallest and largest doses per kg. actually became free from trypanosomes after one injection, and the author thinks that a determining factor in this is the interval elapsing between infection and treatment. In a second experiment the dose of the drug was reduced to 1.5 g. injected as before and, in three out of four animals, sterilisation was effected after two and three injections. The method appears to be promising for field work.

No indication was obtained that the trypanosomes developed any degree of drug fastness.

The author describes a method of testing sterility by means of inoculation with infective guinea-pig blood. It is not yet determined what interval should be allowed to elapse between treatment and test. In view of the susceptibility of animals, premunised against one strain, to infection with another strain, it becomes necessary to take steps to ascertain how many strains there may be. The author proposes to do this by testing any new strain upon animals premunised against strains already collected.

PARKIN, B. S. (1930.) **Antimony Therapy in Equine Trypanosomiasis** (*Trypanosoma brucei*). 16th Rpt. Direct. Vet. Ser. & Anim. Indust., Union of S. Africa. pp. 55-57. Pretoria: Govt. Printer.

References in the literature appeared to suggest that favourable results were not to be expected from the treatment of *T. brucei* infection in horses with salts of antimony; but in view of the favourable results obtained in cattle infected with *T. congolense*, a small preliminary experiment with horses was planned. The experiment is reported in this paper as yielding promising results, and the investigation will be continued.

As 12 per cent. antimosan solution was found to favour abscess-formation, the 7 per cent. solution was used. This, it was found, could be injected in amounts of even 40 c.c. subcutaneously, on a number of occasions at intervals of a week, without abscess formation occurring.

A tabular statement gives the essentials of experiments carried out with five horses and three controls.

It was found that doses of 3 to 6 g. of antimosin per 300-400 kg. body-weight produced a prompt improvement in condition. It would appear that two doses at an interval of a week are not sufficient to produce either sterilisation or premunition. In one instance an animal so treated relapsed, but recovered when a course of five doses was given. One animal died and one recovered with the two injections only. In the case of the animal which died, the interval between the doses was 23 days. Five doses at intervals of a week effected complete sterilisation in one case, and premunition in two others.



- TURNER, A. W., and MURNAME, D. (1930.) **Trypanosomes in the Blood of Victorian Animals.**  
**I. A Preliminary Note on the Occurrence of *Trypanosoma theileri* in the Blood of Cattle.** *Jl. Sci. & Indust. Res., Australia.* **3.** 120-121. [1 fig.]  
**II. On the Presence of *Trypanosoma melophagium* in the Blood of Victorian Sheep, and its Transmission by the Sheep "Tick" *Melophagus ovinus*.** *Ibid.* 121-122. [2 figs.]

I. Having shown the existence of *T. melophagium* in Australia, the authors considered it worth while to search for the cattle trypanosome. They examined the deposit of centrifuged, laked, defibrinated blood obtained at the Melbourne City abattoirs and found a few specimens of an apparently non-pathogenic large trypanosome, morphologically similar to *T. theileri*. Two trypanosomes in smeared-out deposit measured  $52.5 \mu \times 3.75 \mu$  and  $66 \mu \times 4 \mu$  respectively. A detailed description is promised in a future publication. A photomicrograph of a stained specimen is shown.

II. *T. melophagium* has apparently not hitherto been observed in Australia. By the microscopical examination of centrifuged, laked, defibrinated sheep's blood, the authors found trypanosomes. The parasites were present in three out of five sheep which were mildly infected with keds, and were absent from the samples examined from three young ked-free sheep.

They were large, actively motile, and varied in length from  $40.75 \mu$  to  $53.75 \mu$  long by  $2.25 \mu$  to  $2.75 \mu$  broad. Illustrations of three specimens are shown.

The authors confirmed the work in which HOARE demonstrated that infection of the sheep occurs by ingestion of the parasites excreted by the keds and not by inoculation when the latter feed.

The highest degree of infection the authors produced was in a lamb from which the spleen had been previously removed. After infection, trypanosomes were present in every drop of blood examined microscopically.

- DE KOCK, G. (1930.) **A Short Note on Chronic Anaplasmosis and Gonderiasis in Small Ruminants after Splenectomy.** *16th Rpt. Direct. Vet. Ser. and Anim. Indust., Union of S. Africa.* pp. 8-10. Pretoria: Govt. Printer.

The object of this short paper is to place on record the occurrence of anaplasmosis and gonderiasis in small ruminants for several years after splenectomy. Previous observations were made on these cases by DE KOCK and QUINLAN in 1927. The authors hold that *Gonderia ovis* has no pathogenic powers even after splenectomy has been performed.

The bulk of this paper is made up of tabular statements; only a prefatory paragraph and conclusions are otherwise given.

Anaplasmosis has been found to persist in a sheep and goat for five years, and these animals are still being kept under observation.

In some animals there was anæmia which was sufficiently severe to be recognised clinically. Except when blood counts were very low, there were no changes observed in the leucocytes. When the counts were low, there was monocytosis with erythrophagocytosis. After some of the remissions of severe anæmia an eosinophilia was observed.

In one goat anaplasmosis was ultimately associated with a definite oligocythæmia. This controverted an opinion held previously. The removal of the spleen appears to interfere with the immunisation mechanism.

- TALLIAFERRO, W. H., and TALLIAFERRO, L. G. (1930.) **Cellular Immunity in acquired Avian Malaria.** *Amer. Jl. Path.* **6.** 592.

The authors had previously found that canaries may possess immunity to super-infection with *Plasmodium cathemerium*, and that it is not due to the presence of antibodies contained in the serum. They now describe the results of a study of the cellular reactions which occur in the course of the development of immunity.

They examined microscopically the blood and organs of artificially infected birds, and found that, in a primary infection produced by inoculation with parasitised blood cells, there is a phagocytic response with ingestion of the foreign blood cells and their contained parasites; but that the action is not complete, and that many parasites escape destruction, sporulate, and lead to a crisis about eight

days later. After this point, however, phagocytosis evidently increases and the parasites are overcome. If birds which have passed through such a reaction are given a second injection of plasmodium-containing blood cells, the phagocytic response is much greater than in the first instance, and the invaders are all removed from the blood.

The spleen appears to take a leading part in the production of phagocytes, and the liver shares in this action, but to a smaller extent.

REES, Charles W. (1930.) **Studies on the Morphology and Behaviour of *Buxtonella sulcata* from Cattle and of *Balantidium coli* from the Pig.** *Parasitology*. **22**. 314-325. [1 plate, 6 text figs.]

REES describes the detection, in the cæcum of 8 out of 32 cattle, of *Buxtonella sulcata* recorded by JAMESON (1926) as occurring in cattle in England. The infestations were all light. For isolation the author used a pipette composed of two pieces of glass tubing connected by a piece of rubber tubing. One piece of glass tubing is drawn to a capillary point and bent at an angle, while the free end of the other piece of tube is sealed. The control of liquid drawn into the pipette is exercised by pressure on the piece of rubber tubing connecting the pieces of glass tubing.

A detailed description is given of the technique employed for staining and sectioning the organism.

Measurements of the specimens from the American cattle showed that the organisms were considerably larger than those described by JAMESON in England, but the author thinks that the differences in the intensity of the infestations may have accounted for this. For details of the anatomy of the parasite the original must be consulted. Trophozoites could be found in the fæces by causing purgation with Epsom salts. As the fæces returned to normal the trophozoite stage was gradually replaced by the encysted stage. This was observed about 19 hours after the administration of the purgative.

The author gives an account of the general behaviour of the organism as regards motility, etc., and deals also with the influence of temperature upon its viability.

It is suggested that *Buxtonella sulcata* be removed from the Class *Aspirigera*, family *Isotrichidæ*, and included in the Class *Spirigera*, Order *Heterotrichida*.

WEAVER, C. H. (1930.) **Turkey Rearing in Confinement for the Control of "Blackhead" (*Enterohepatitis*).** *Rpt. Vet., Director-General, Health of Animals Branch, Dept. Agric., Canada (Animal Pathology Division)*. Appendix No. 3. pp. 50-53. Ottawa: F. A. Acland. [8vo.]

During recent years there has been considerable change in the geographical distribution of turkey raising in Canada on account of the ravages of "blackhead," and it has been impossible to carry on anything more than small-scale operations after the disease has obtained a hold on a locality.

The author attempted to rear turkeys in close proximity to a poultry "plant" known to be badly infested with intestinal parasites. This point is important, because of the association of the "blackhead" *Amœba* with the *Heterakis* in the cæca, and the knowledge that cæca worms are very easily carried about by human agencies. Accordingly, the scheme adopted was based on the prevention of avenues of infection between the source (poultry "plant") and the young turkeys during brooding and rearing. The nutritional requirements of turkeys are more varied than those of fowls, so that, unless these are given full consideration, measures taken to prevent one disease may lead to the production of others which may be more serious. The habits of turkeys cause certain difficulties when attempts are made to rear them in confinement and to feed them out of hoppers; birds which fall behind the rest of the flock in vitality are crowded out by the others. The author's scheme depended upon confining the stock and moving it periodically in portable yards.

One hundred eggs were purchased in a market, and incubated artificially; 43 were hatched, and were placed in battery brooders. Green food was purposely withheld as long as possible owing to the danger of parasitic contamination, and 18 days after hatching, some of the chicks suddenly showed evidence of vitamin B deficiency; admission to direct sunlight and the addition of green feed did not altogether prevent the development of the trouble in other chicks.

On the 41st day the 31 surviving chicks were put in outdoor coops with covered runs (6 ft. by



12 ft.), and placed on grass with clover, and the coops were shifted every two days as the grass got eaten down. By the 61st day the pens were too small for the stock, and it was suffering from a shortage of green feed. It was accordingly moved to current year's sown mixed clover on an area, 24 ft. by 48 ft., with an adjoining house which had been carefully cleaned. By the 73rd day all the clover was eaten; the stock was moved to a similar new yard, and after this no other moves were possible. Later, some birds flew out of the run, and flight feathers had to be cut.

Of twelve birds that died, half were chick losses. Of the remaining six which died or were killed, two had definite lesions, and there was possibly evidence of "blackhead" in two others: the other two deaths were due to faulty nutrition. The birds which were affected with "blackhead" showed very slight lesions in comparison with what is seen in ordinary outbreaks.

At the 199th day, 19 of the turkeys were killed and examined in great detail. The average weight was 15.1 lb. The internal organs of all the birds were normal; the intestines were free from worms, and there were no indications of nutritional deficiency disease.

SCHILLING, Claus, and SCHRECK, Hans. (1930.) **The Influence of Passage through the Invertebrate Host on the Biological Characters of Parasitic Protozoa.** *Ann. Trop. Med. Parasit.* **24.** 437-442.

In the course of chronic infections by protozoa and spirochaetes, the parasites lose their capacity for reacting to serum antibodies, and develop into so-called "serum-fast," or "relapse" strains. Similarly, they may become "drug-fast." The authors' experiments were designed to find out whether these "relapse" strains remain unchanged during their sojourn in a suitable insect transmitter or whether they revert to the natural type. Strains may show considerable serological and immunological differentiation, and prophylactic or curative treatment will obviously be more complicated and difficult if there is an indefinite number of such strains. The authors worked in German East Africa between 1912 and 1914 and used in their experiments two strains of *T. brucei*, one an old strain maintained artificially (so-called "Hamburg alt" strain), and the other a fresh strain obtained from a gnu. Tsetse flies were caught on the mainland and taken to the place at which the experiments were carried out, an island off the coast (near Dar-es-Salaam). At this place the flies produced a new generation, the members of which alone were used in the experiments. Laboratory tests with trypanosomes and serum from several animals, as well as tests on various living animals, were carried out and it was eventually found that after passage through the flies, the "Hamburg alt" strain reverted to the original type and was identical with the genuine natural gnu strain.

It appears then that the sexual development of trypanosomes which occurs in the body of tsetse flies, eliminates the properties which the organism may have acquired during its existence in its mammalian host. This knowledge is of great importance in connection with the immunisation of animals against trypanosome infection as it indicates that operations need only be instituted against the natural strains and not against an indefinite number of "relapse" strains.

SÉGUIN, P. (1930.) *Spirochaeta gallinarum* et formes dites "ultra-virus." [*Spirochaeta Gallinarum* and the so-called "Ultra-Virus" Forms.] *C.R. Soc. Biol.* **104.** 836-838.

The author has previously described extremely small forms of spirochaetes in old cultures of *Treponema calligyrum* which for the lack of a proper term he speaks of as "ultra-virus spirochétique." He searched for similar forms in cultures of *S. gallinarum*. A photo-micrograph in the text shows these minute forms in various stages of fragmentation. The forms photographed by the author are said to be different from so-called involution forms.

NEITZ, W. O., and CANHAM, A. S. (1930.) **A Short Note on the Spirochaetal Wound Infection of Pigs.** *16th Rpt. Direct. Vet. Ser. & Anim. Indust., Union of S. Africa.* pp. 69-72. Pretoria: Govt. Printer.

Spirochaetal wound infection is a chronic condition involving the skin and subcutaneous tissues. In a minority of cases lesions occur in the lungs and bladder. The disease is caused by *Spirochaeta suilla* and associated fusiform bacilli.

The condition, or a similar one, is known to occur in Australia and New Zealand.

The parasite does not appear to invade the blood stream, but it can be found readily in the lesions by ordinary staining methods such as Giemsa.

The condition is intimately associated with wounds—accidental or surgical—and unfavourable hygienic conditions.

In cases of infection of the scrotum after castration, enormous swelling due to the formation of fibrous tissue occurs. Centres of evil-smelling pus are scattered through the fibrous areas, and the pus escapes as a result of necrosis and ulceration of the overlying skin. In lesions of the leg, soft purulent centres do not seem to occur. The presence of even very large lesions did not seem to cause loss of appetite. The temperature fluctuates, and may range from 99-105° F. The mortality is not high.

Treatment with various arsenical compounds by the intravenous route has failed in all cases; but very favourable results followed the direct application of arsenical drugs to ulcerating surfaces and the injection of them into the substance of the tumour-like masses when that was possible. It was not found possible to treat the leg lesions in this way on account of the density of the fibrous tissue.

Affected animals were given either a single injection or a series ranging up to a maximum of twelve at weekly intervals. Cooper's double dipping powder, atoxyl, and neosalvarsan gave good results. Antimosan and aricyl failed.

The maximum dose of the dipping powder was 0.14 g. and, when it was applied externally, a 1.4 per cent. solution was used. The maximum dose of atoxyl injected was 1 g.

Prevention follows general lines, and dipping with arsenicals reduces the incidence. Recovery appears to leave no immunity.

DAUBNEY, R. (1930.) **Heartwater** (*Rickettsia ruminantium*). *Ann. Rpt., Dept. Agric., Kenya*. pp. 325-332. Nairobi: Govt. Printer. [8vo.]

"Heartwater" of sheep, cattle and goats has been recognised in South Africa for nearly a century, and the part played by *Amblyomma hebraeum* in its transmission was demonstrated by Lounsbury thirty years ago. The virus does not pass through the egg, but ticks infected at one stage can pass the virus on at the next, and a larva acquiring the infection may pass it on as an adult if the nymphal stage is passed upon an insusceptible animal. The period of incubation is about 14 days when the disease is tick transmitted, but shorter when blood inoculation is employed. In cattle, nervous symptoms are very pronounced before death.

The characteristic lesion is hydropericardium, but this is not invariably present and it occurs less frequently in cattle than in sheep and goats. The other lesions are engorgement of the spleen, petechial hæmorrhages, gastritis, and congestion of the meningeal vessels. *Amblyomma hebraeum* does not occur in Kenya, but there are two species of *Amblyomma*—*A. gemma* and *A. variegatum*—which occur in tropical Africa, and are not known in South Africa. Of the two, *A. variegatum* is by far the more common. *A. gemma* is of comparatively rare occurrence, and it has therefore not been possible to carry out any experiments with it. Unfortunately, *A. variegatum* is extremely difficult to rear in the laboratory, and, in fact, all attempts to rear it in the writer's laboratory have failed.

The opportunity occurred, however, of demonstrating the natural transmission of "heartwater" by *A. variegatum*, as three naturally contracted cases occurred in a small enclosure at the laboratory. The infection of the enclosure was traced, with every appearance of probability, to two cattle which had been used as virus producers for rinderpest inoculations in the field and had been returned to the laboratory. Subsequently three animals (two sheep and a cow) died of "heartwater" in the paddock, and a small number of *A. variegatum* was collected. A few more were obtained by placing calves in the enclosure and removing the ticks gathered by them.

These ticks were placed on sheep and caused infection. The strain of "heartwater" is still being propagated by blood inoculation and as yet it shows no sign of loss of virulence.

The author found that the prepatent period, after infestation with ticks, was about three weeks, and that the period of incubation, following blood inoculation, was nine to twelve days.

Histological examination of tissues enabled the author to confirm STECK's findings that the characteristic lesions of "heartwater" are leucostasis and perivascular cellulation. He also found that "satellitism" of the neurons is constant in bovines and frequently found in sheep when they survive the onset of the reaction for several days.



## DISEASES CAUSED BY FILTERABLE VIRUSES.

HAYES, F. M. (1931.) **The Application of the Formol Test in the Diagnosis of Hog Cholera.** *Zlb. f. Bakt. (Orig.)*. **119**. 836-839. [In English.]

The author applied the formol-gel test, as described by GATÉ and PAPAΚOSTAS and others, to the serum of 16 pigs affected with swine fever. He used the technique described by CERNIAMU (1928), but modified it in some instances. Of 41 tests carried out, altogether, 22 were with the blood of normal swine.

The test did not appear to be of any value for the diagnosis of swine fever. Infected animals often yielded negative reactions, and positive ones were obtained with serum from normal animals.

MIROTVORSKY, K. A. (1930.) Opyt primenyeniya formol-vaktziny s predokhranitel'noy tzyeliyu pri yashchourye kroupnoy rogovoy skota. [**Experiments with Formol-Vaccine as a Prophylactic in Foot-and-Mouth Disease of Cattle.**] *Vestnik. Sovr. Veter.* Nos. 3 and 4, February. 80-81. [In Russian.]

The author carried out tests in Russian Turkestan on 485 cattle belonging to several herds. Formol-vaccine was prepared according to the method described by VALLÉE, CARRÉ and RINJARD; virulent material was obtained from infected cattle from mature *aphthæ* in the buccal cavity and tested once on guinea-pigs and twice on calves. 18,675 c.c. of the vaccine were prepared, and it was avirulent for guinea-pigs. Each infected bovine animal yielded, on an average, a quantity of virus sufficient for the preparation of 15-25 doses for cattle, a dose being 10 c.c.

At the time the inoculations were carried out, 49 cattle were infected, and the vaccine was used on 363 healthy animals. 25 animals (7 per cent.) contracted the disease after inoculation. In two untreated herds, 50 and 55 per cent. respectively of the animals contracted the disease. Further experiments were carried out at a cattle fair in the same district; 404 cattle were inoculated and only 8 per cent. became infected.

The vaccine reduced the number of cases from 50 and 55 per cent. to 7 and 8 per cent. respectively. The disease died out after inoculation. Immunity was conferred within 9-13 days after vaccination. When inoculated animals became infected, they recovered rapidly without any untoward sequelæ, whereas the untreated cattle passed through a severe attack of the disease. The vaccine is harmless and does not produce any disturbance in health. Subsequent observations proved that the duration of immunity thus conferred was one to one and a half months.

HELM, R., and CURTZE, W. (1930.) Die Abtötung des Virus der Maul- und Klauenseuche durch Hitze und heiss angewandte Desinfektionsmittellösungen. [**The Destruction of the Virus of Foot-and-Mouth Disease by Heat and Hot Solutions of Disinfectants.**] *Arch. f. Wiss. u. prakt. Tierhkl.* **62**. 489-506.

The authors studied the efficiency of physical and chemical agents, used at various temperatures, for the destruction of the virus of foot-and-mouth disease.

DISINFECTION BY HEAT.—The material used in these experiments was 24-hour and 48-hour old *aphthæ* from guinea-pigs infected with two uniformly pathogenic strains of the virus.

1. Shreds of *aphthæ* freshly obtained from guinea-pigs were placed in Petri dishes kept at 60° C., and pieces (which had become dry and hard after three hours) were removed periodically and tested on guinea-pigs for virulence. After three or four hours the 24-hour old tissue was found to be more resistant than the 48-hour-old tissue, but the virus from both sources was dead after six hours.

2. Virus, subjected to a temperature of 60° C. in a very moist atmosphere, produced by the simultaneous evaporation of water in the incubator, was attenuated in two hours and dead in five hours. In moist heat the age of the tissue appeared to be of less importance than in the tests with dry heat.

3. Virus placed in water kept at 60° C. was killed in 90 minutes, and there was no difference between one or two-day old tissue.

4. Four out of five lots of virus placed under the same conditions in physiological saline were killed in 45 minutes, and every lot was killed with certainty in 60 minutes, but there was no difference with regard to age.

5. Shreds of 48-hour-old *aphthæ* were placed in a large volume of bovine and porcine fæces,

which after six hours in the incubator had reached a temperature of 57° C. Two out of eight lots of virus were still virulent after 24 hours in bovine faeces, but every sample was dead after 30 hours. Three out of five lots of virus were still virulent after 24 hours in porcine faeces, but all were dead after 30 hours. In similar experiments with faeces kept at 37° C., virus was dead after 48 hours in bovine faeces and after 72 hours in porcine faeces. Bovine faeces appear to possess some substance which helps to destroy the virus, but porcine faeces appear to lack this factor or to be relatively deficient in it.

**DISINFECTION WITH HOT CHEMICALS.**—To gain information as to the degree to which hot solutions cool down when poured on to a flat surface, such as occurs when buildings, cattle trucks, etc., are dealt with, the authors studied the effect, on virulent material, of disinfectants in shallow containers with a large surface. They used flat vessels, 7 in. in diameter, filled to a depth of about  $\frac{1}{4}$  in. with the disinfectant fluids. After pouring out the particular heated solution, the temperature was recorded at one minute intervals for 30 minutes, and pieces of the tissue which were kept under the surface during the period of observation were removed at fixed intervals for tests of virulence. The external temperature and humidity were recorded in every case.

When water or disinfectant fluid at 80° C. was employed, the temperature fell on an average to 32° C. in ten minutes, and to 8° C. in 20 minutes. External temperature and humidity affected the rate of fall, but not the shape of the plotted curve.

1. **DISINFECTION WITH HOT WATER AT 100° C.**—At the end of 20 minutes, by which time the temperature was 25-30° C., the virus was always dead: the authors ascribe this effect to the short period during which the water remained above 60° C. Further experiments were made with water at 80° C., both indoors and outdoors; the results varied somewhat, the virus being killed in some cases within five minutes and in two cases being still alive after 30 minutes.

2. **DISINFECTION WITH HOT SULFOLIQUD.**—With 0.5 per cent. solutions, heated to 100° C., the virus was killed in most cases after ten minutes and in all cases after 20 minutes. With a solution heated to 80° C., it was still alive after 30 minutes' exposure.

3. **DISINFECTION WITH SULFALYD SOLUTION.**—With 0.5 and 1.0 per cent. solutions heated to 80° C., the virus was usually attenuated after 15 minutes and killed after 30 minutes. The weaker solution appeared to be the more effective of the two, but the heating did not increase its potency much.

4. **DISINFECTION WITH HOT CAUSTIC SODA.**—The disinfectant action was markedly improved when a 1 per cent. solution was heated to 80° C., and in nearly every case the virus was dead after one minute. In one instance, however, it was alive after 15 minutes, so a period of 20 minutes must be considered to be necessary for disinfection. It was killed after 25 minutes' exposure to 1 per cent. caustic soda at 50° C.

The authors realise that these experiments are hardly comparable with conditions that are encountered in practice.

JACOTOT, H. (1930.) Sur la sensibilité du lapin au virus de la peste bovine. [The Susceptibility of the Rabbit to Rinderpest.] *Bull. Soc. Path. Éxot.* 23. 904-909.

The author had observed that among animals of the susceptible species, certain individuals, and especially the individuals of certain breeds, pass through an imperceptible attack of rinderpest. He carried out some experiments to ascertain if, although rabbits are considered to be insusceptible to the disease, observation would show whether any of them would pass through such an imperceptible attack when submitted to the action of virulent material.

In an endeavour to obtain distinct reactions, he gave the test rabbits a preliminary subcutaneous inoculation with formol-treated material from infected calves as he had observed that although such material is devoid of immunising properties, its administration sensitises susceptible animals to a test dose of virus.

The experiments consisted of inoculating virus into sensitised rabbits, testing the effect of inoculating blood and tissue pulp obtained from them, into calves and into other rabbits, at various intervals; and of further inoculations from the rabbits of the second generation, and so on.

The author considered that sensitised rabbits of the first passage were infected six times in nine experiments. In the experiments which yielded positive results, the virus was demonstrated on the fifth and sixth days after inoculation. All attempts to demonstrate virus in rabbits of the second



passage yielded negative results. On one occasion a positive result was obtained in the fourth passage, but the author considers that this should be accepted with reserve. No disturbance in health was observed in the rabbits from which virus was demonstrated, but in the case of those which were destroyed for the purpose of obtaining organ tissue for the preparation of virulent pulp and the whole of the blood for massive inoculations, there was slight catarrh of the digestive mucosa in odd instances.

No references are quoted on work with the rinderpest virus on rabbits, and no details are given concerning precautions for the isolation of the animals while under observation.

WALKER, J. (1930.) **Rinderpest.** *Ann. Rpt., Dept. Agric., Kenya.* pp. 184-210. Nairobi: Govt Printer. [8vo.]

The points regarding which research has been prosecuted are the following:—

1. The potency of serum of non-hyperimmunised cattle.
2. The potency of serum of different bleedings after hyperimmunisation.
3. Vaccination with inactivated, toluol-treated spleen extract.
  - (a) Duration of immunity in animals vaccinated prior to weaning.
  - (b) Duration of immunity in animals vaccinated at other ages.
  - (c) Active immunisation with inactivated spleen pulp and virulent blood.
  - (d) The potency of peritoneal washings and virulent blood.
  - (e) The keeping properties of inactivated vaccine.

1. The author gives only a bare summary of the experiments, and his findings are:—the serum of a recovered virus producer protects against death at doses of 10, 15, 20 and 30 c.c., but not against a severe reaction at doses of 10 c.c. and 30 c.c. Similar results were obtained with serum from two animals immunised by the simultaneous method. The serum produced by three injections of inactivated spleen pulp, protected against severe reactions at doses of 10, 15, 20 and 30 c.c.

2. Hyperimmunisation was effected by the injection of virulent blood at the rate of 15 c.c. per kilo, intramuscularly, into an animal immunised by the simultaneous method a fortnight previously. After an interval of "several days," bleedings were begun and four litres were withdrawn once a week for six weeks. The sera obtained at these six bleedings were tested separately, and they were found to be as potent as the serum from the recovered virus producer and from the actively immunised animal. The animal from which the six bleedings were taken had been used for serum production since 1927. In the case of a native animal, which had been in use as a serum maker since 1926, the sixth bleeding was less potent.

3. The spleen extract was prepared by mincing the spleens of a number of virus producers and adding four volumes of normal saline and toluol to make 1 per cent. of the total. The whole was strained through muslin, incubated at 38° C. for 72 hours, and stored at temperatures ranging from 5° C. to room temperature (according to the supplies of ice).

Tabular statements of the experiments show the details of the tests, including the variations in the amounts injected and the intervals between doses.

It was found that three injections of inactivated spleen pulp, followed at 13 days with a dose of virulent blood, did not as a rule protect unweaned calves against contact infection or inoculation after weaning.

Weaned cattle injected with three doses of spleen pulp are not protected after an interval of some months against contact infection or inoculation.

The simultaneous injection of spleen vaccine and virulent blood was found to be unsafe. To test the value of spleen vaccine with virulent blood, three methods of treating the spleen pulp were used:—

- (a) Spleen tissue was pulped. 0.4 c.c. per g. of normal saline were added, and the mixture was stored at 5° C. for 18 hours. 3.6 c.c. of water per g. were then added, and formalin to make 1:800 of the total. This was kept in the ice chest for 72 hours and then stored at room temperature till used.
- (b) As above, except that 4 c.c. of saline per g. of pulp were added immediately after pulping.
- (c) 4 c.c. of saline per g. of pulp and toluol to make 1 per cent. were added. The mixture was incubated at 37° C. for 90 hours, and then stored at room temperature.

It was concluded from the experiments performed that a single dose of formalised vaccine may

block out a reaction to fresh virus given up to 21 days later. Similar results were obtained with two and three injections of formalised virus.

The quantity of vaccine which blocks out a reaction, when given in three doses at intervals of a week, does not necessarily block out a reaction when given as one dose or as two doses.

On account of the variations in the susceptibility of animals, further experimentation is required to ascertain the value of the spleen pulp for use in simultaneous inoculation.

Experiments showed that inactivated peritoneal washings and clot from virulent blood, were devoid of immunising properties.

The spleen pulp inactivated with toluol was found to contain immunising bodies seven and a half months after preparation when stored at 5° C.

DAUBNEY, R. (1930.) **Rinderpest.** *Ann. Rpt., Dept. Agric., Kenya.* pp. 210-224. Nairobi : Govt. Printer. [8 vo.]

This paper deals with two aspects of the rinderpest problem, namely, rinderpest prophylactic vaccination, and the transmission of protozoan diseases through rinderpest double inoculation. The author summarises at some length the results reported to the Pan-African Veterinary Conference, Pretoria, in Bulletin 8b of 1929 (Dept. Agric., Kenya).

Reference is made to the objection raised to serum-simultaneous inoculation, on the ground that the disease is spread during the inoculations, and that it is impossible to eradicate rinderpest in countries where this method is widely resorted to. It is suggested that the long duration of the immunity conferred is due to the frequent recurrence of symptomless infections derived from centres of disease set up during double inoculations. " There can now be little doubt that in animals guarded from all risk of re-infection, immunity begins to decline at between two and three years after serum-simultaneous inoculation." The application of long-term immunity tests must be an essential part in any attempt to assess the value of any method of protective inoculation, and the possibility of re-inforcement of immunity by symptomless re-infections must not be lost sight of.

The aim of the Department is to avoid the use of any type of vaccine which might provoke any reaction whatever.

Experiments with completely inactivated virus, as suggested by JACOTOT in Indo-China, have not furnished the results indicated by that author. The resistance to infection established by the vaccine exists for a short time, but it dies out within a few months and an inoculation with virulent material, while the condition of resistance is in existence, does not produce any lasting immunity.

It would seem that a vaccine which is not completely inactivated will be necessary for the establishment of a valuable degree of immunity. The probability is suggested that the immunity conferred by inactivated vaccine, can be strengthened to a degree sufficient to make it of practical utility, by a reinforcing dose of partially inactivated vaccine.

In the author's view the use of virulent blood for the reinforcement of the immunity produced by completely inactivated vaccine, fails unless actual infection is established. The favourable effect of attenuated spleen vaccine in the same circumstances is attributed to the larger amount of virus used.

The author is unable to agree with KELSEY that liver is a suitable material for the preparation of vaccine and agrees with BOYNTON and the Japanese writers.

An improvement in the technique of the vaccine preparation has resulted from the " explosion " of the tissue under the osmotic pressure of a concentrated salt solution. 9 per cent. salt solution is used for addition to the pulped mass and the strength is brought to the physiological standard by subsequent dilution. This achieves a more even distribution of the virus and, consequently, permits more accurate titration. By this means the stage has been reached at which a standard minimal virus content per unit of vaccine can be laid down. It is considered that tissues, in order to produce the highest grade of vaccine, should contain something in excess of 10,000 minimal infective doses per g.

Two points are still to be considered, namely, the safety of the vaccine with regard to the possible production of rinderpest, and the possibilities of accidental contamination leading to abscess formation. It is considered that improvements in technique and apparatus employed largely eliminate these dangers.

TRANSMISSION OF PROTOZOAN DISEASES THROUGH THE DOUBLE INOCULATION METHOD.—The



laboratory has been using "clean" animals for virus producers. These animals have been infected by subcutaneous inoculation with nasal discharge from ordinary laboratory virus producers. Field officers have found that while the blood of these animals appears to be safe up to the fifth day, blood taken from them on the seventh day has been responsible for the transmission of redwater. It would seem that the infection of the virus producers is due to traces of blood in the nasal discharge used.

The osmotic pressure method of liberating virus suggested a means of obtaining virus free from any danger of containing protozoan parasites. This was tested by treating spleen pulp containing enormous numbers of redwater parasites in the manner described. Inoculation of the supernatant fluid, obtained after centrifuging, into six susceptible animals failed to produce any reaction or infection.

Although rinderpest virus has been found to survive for as long as eight days in the spleen emulsion at cool room temperature, it has not been used for the inoculation of field controls more than three days after preparation.

INOUE, T., HARADA, S., and SHIMIZU, T. (1930.) **Preliminary Note on the Experimental Infection with the Rinderpest Virus in Susliks.** *Select. Contrib. Mukden Inst. Infect. Dis. of Animals.* 1. 221-222. [From English Summary.]

From the manner in which rinderpest recurred in Mongolia and Manchuria, the authors suspected that a local "carrier" existed. In 1927 they inoculated a suslik subcutaneously with 20 c.c. of virulent rinderpest blood, and it died in seven days after showing a temperature reaction. *Post-mortem* examination showed hæmorrhages and ulcers of the gastric mucous membrane. Five days later [method of storage not given], a suspension of spleen and lung tissue was inoculated into a healthy calf and it contracted typical rinderpest.

In 1928 the authors passed rinderpest virus through susliks and carried it up to the 24th generation, testing the passage virus at intervals on calves with positive results. Passage of the virus through susliks made it less infective for that species, but material from inoculated susliks which had shown no reaction was infective to calves, and calves were infected with virus of the 24th generation in susliks.

The author considers that these animals possibly act as "carriers" of the rinderpest virus.

REMLINGER, P., and BAILLY, J. (1930.) **Unité ou pluralité du virus rabique. (The Unicity or Plurality of the Rabic Virus.)** *Ann. Inst. Pasteur.* 45. 376-385. [1 table.]

On *a priori* grounds there seems to be no reason why there should not be different types of rabic virus, as there are different types of bacteria such as meningococci (A, B, C and D), paratyphoid organisms, and so on.

It is true that variations occur in the characters of the various "street viruses" that are known. They vary, for example, in the rapidity with which they can be transformed into fixed viruses and in the clinical pictures which they produce, but these peculiarities all appear to be variations in activity. There seems to be no essential variation in the pathogenic agents themselves.

Reference is made to the explanations that are offered for the failure to protect by vaccination on the grounds of plurality of virus, but the authors do not hold the opinion that this explanation is supported by facts.

They point out that if there is any rabic virus which differs from the classical virus, it is that which causes the rabies-like disease of dogs in Central Africa (the so-called Oulou Fato). Cross tests have, however, shown that, essentially, this virus is identical with the classical virus in spite of the characters of the disease caused by it, namely, small tendency to transmission by bites, infrequency of furious attacks and the rapidity of development of dumb rabies. The authors hold that this proof furnishes ample ground for doubting the "para-rabic" nature of other viruses which differ from the typical virus to a far less extent.

The subject came under the consideration of the International Conference on Rabies in 1927, and it was resolved that the matter should be investigated thoroughly. Proof of plurality would be not only of scientific interest, but would introduce complications into the practice of protective inoculation. In order to make the testing of viruses a practical proposition, it was arranged that experiments should be carried out with (a) viruses isolated from persons dying of rabies after failure of treatment when the bites did not appear to be serious, and (b) viruses of animals which presented

abnormalities of manifestation, the presence of virus being established by rabbit inoculation. Nothing came of these arrangements.

In January, 1929, TEODORASCU reported the isolation of two viruses from persons bitten who died in spite of intensive treatment; they showed a complete absence of cross immunity with the fixed virus used for the treatment. Details of cross immunity tests carried out by the authors with the Roumanian and the Tangier viruses are given, and these show that the Roumanian virus is identical with the classical virus.

In order, however, to carry the matter further, a number of experiments were carried out with anti-sera prepared from fixed virus, Moroccan street virus, and the Roumanian street virus. In all the experiments, serum prepared with the Roumanian virus as antigen proved to be devoid of protective properties against all three viruses, while the anti-fixed-virus serum and anti-moroccan-virus serum, each protected against the three viruses.

The authors refer briefly to possible explanations—the individual animal used for the serum production, the virus, etc., and state that even if it be found eventually that the Roumanian virus is deficient in antigenic properties, that fact would have plenty of analogies in experimental medicine. As a case in point, they instance pneumococci as possessing very feeble antigenic powers. The important fact, however, is that the “anti-fixed,” “anti-moroccan” and “anti-roumanian” sera, behave in an identical manner to the three viruses, and this suffices to identify the Roumanian virus with the classical virus. It would be interesting, should it be definitely established that the Roumanian virus is incapable of eliciting antibody formation, but it would only be a variation, and not an essential factor.

The authors hoped to have been able to carry out parallel experiments with the virus of “recurrent” rabies described by CHINI, but they were unable to obtain a sample.

They conclude that, while there may be differences in “aggressiveness” in viruses from different parts of the world, the viruses are in essence identical. They hold that polyvalent and auto-vaccines are unnecessary complications.

RASCH, Kurt. (1930.) Experimentelle Untersuchungen über den Impfstoff gegen Taubenpocken nach Lahaye. (**Experimental Examination of the Lahaye Vaccine against Pigeon-pox.**) *Zeitschr. f. Infektkr. d. Haust.* 38. 37-41.

The author places on record a small number of experiments carried out with vaccine obtained from the Antwerp Laboratories. Two rabbits were inoculated by scarification of the skin, and two into the cornea.

Those inoculated intracutaneously developed nodules which were about as large as peas on the 12th day. It was not found possible to pass the virus on to other rabbits. Microscopic examination of an excised nodule showed a circumscribed cellular infiltration of the corium with a necrotic centre. The corneal inoculations failed and no histological changes could be detected. Six pigeons were inoculated cutaneously on the leg according to the directions, and two on the side of the breast. All the birds showed pronounced reactions, particularly those inoculated on the breast. The leg lesions persisted for three to five weeks. Two birds developed lesions of the mouth, and one a yellow lesion as large as a pin's head on the tongue. The two birds inoculated on the breast died on the 29th day. Details of the *post-mortem* examinations are given. An organism belonging to the *Bacillus enteriditis* Breslau type was recovered in pure culture, and bacteriological examination of the original vaccine showed that the same organism was present in it also.

The six birds vaccinated according to the instructions issued with the vaccine, were inoculated, along with three controls, with virulent pigeon-pox virus cutaneously. All developed extensive pox lesions.

Three fowls were inoculated on the leg and the comb with the original vaccine. All three developed inoculation reactions. When tested with virulent fowl-pox along with two controls, 37 days after vaccination, all five became infected. The three vaccinated birds and one control developed specific mouth lesions.

In the author's opinion the Lahaye vaccine is a mixture of pigeon and fowl-pox virus—the former predominating. The reactions to vaccination were very pronounced in pigeons, but no active immunity against pigeon-pox could be demonstrated. The vaccine was heavily contaminated with a bacillus of the *B. enteriditis* Breslau type, and it is probable that some of the lesions produced in the



experimental animals were due to this organism. Possibly the birds from which the vaccine was prepared were suffering from latent infection.

ZWICK, W., and WITTE, J. (1931.) Ueber die Widerstandsfähigkeit des Virus der Bornaschen Krankheit gegen Trocknung und über Schutzimpfung mit getrockneter virushaltigen Gehirnsubstanz. [The resistance of the Virus of Borna Disease to Drying and Experiments in Protective Inoculation with Dried Virulent Brain Material.] *Berl. Tier. Woch.* 47, 33-35.

The authors refer to their previous work in which they demonstrated that Borna virus from affected rabbits was killed in a short time when the brain tissue containing it was dried. They now report on further experiments in which they obtained very different results with various strains of the virus in similar material.

The infective material was dried by spreading it in thin layers on Petri dishes, and placing them in a vacuum over calcium chloride, or by the use of the Faust-Heim apparatus, employing room or body temperatures in different trials. The lots so prepared were tested for virulence after various intervals by intra-cerebral inoculation into rabbits.

After desiccation *in vacuo* at 5° C. over calcium chloride, virus was still infective in one instance after 326 days; in another instance it was attenuated after 177 days. The incubation period of the infection set up by this dried virus varied considerably after subcutaneous inoculation, but was practically constant after intracerebral inoculation. Virus dried at room temperature in the Faust-Heim apparatus was virulent after 48 hours, but two lots dried for 33 and 60 days were avirulent. Virus dried at 37° C. in the same apparatus, was attenuated after 48 hours, and dead after 14 days.

The authors used dried virus in immunisation experiments on rabbits: ten rabbits were given three subcutaneous injections of dried virus at five-day intervals, and five of them died 50-77 days after the first inoculation. The five survivors remained healthy when given virulent brain material intracerebrally three months later; ten controls died after the usual interval. Five rabbits inoculated cutaneously failed to develop any immunity.

Experiments are to be undertaken on the immunisation of horses by repeated subcutaneous inoculations with dried virus.

DU TOIT, P. J., and ALEXANDER, R. A. (1930.) **The Immunisation of Horses against Horse-Sickness by the Use of Formalized Virus.** 16th Rpt. Direct. Vet. Ser. & Anim. Indust., Union of S. Africa. pp. 85-103. Pretoria: Govt. Printer.

This paper is in the nature of a progress report, and no attempt is made to discuss the relative merits of methods. A comprehensive article is promised at a future date.

The work was instituted in consequence of the results published by DUNKIN and LAIDLAW in connection with immunisation against canine distemper.

Susceptible horses are injected intravenously with 5 c.c. of O virus (the most virulent virus encountered at Onderstepoort). There is a steady rise of temperature up to 106°-108° F. in three days; it remains practically steady for one to three days, and death occurs by crisis.

Blood for formalisation is drawn from the jugular vein and defibrinated or citrated. The amount of formalin added has been varied in different experiments. When tissue emulsion is required an infected animal is shot when *in extremis*. The required organs are removed aseptically and ground in a Latapie apparatus. The weight of the pulp is obtained, and four times this amount of sterile 0.9 per cent. saline is added. To this, 4 per cent. formalin is added until the required concentration is reached. This has also varied in different experiments. Prior to injection, the formalized emulsion is filtered through two layers of sterile butter muslin.

Details of eleven experiments are given, and these are tabulated. It is not practicable to give the variations in technique in the different experiments, but the general conclusions which have been tentatively drawn are as follows:—it has been found possible to produce a solid immunity against horse-sickness by the subcutaneous injection of virulent spleen emulsion which is decreasingly inactivated by progressively lower concentrations of formalin.

The minimum concentration of formalin which will produce an inactivated virus that can be injected with safety and yet produce a partial immunity, has not been established. A 1:1,000 concentration appears to be perfectly safe. 1:2,000 and 1:3,000 are uncertain, while 1:4,000 concentration certainly fails to ensure sufficient inactivation.

Horses which resist an injection of tissue inactivated by 1 : 6,000 formalin, are found to be completely immune to the homologous virus.

While every possible step is taken to ensure freedom from bacterial contamination, a concentration of 1 : 4,000 can be relied upon to inhibit the growth of probable contaminants.

It is probable that the immunity produced by inactivated vaccine is temporary and the final injection should, in order to produce lasting immunity, be untreated virulent virus.

WALKER, J. (1930.) **Pleuro-pneumonia contagiosa Bovum (Lung Sickness of Cattle).** *Ann. Rpt. Dept. Agric., Kenya.* pp. 240-243. Nairobi: Govt. Printer. [8vo.]

An attempt was made to prepare a vaccine against pleuro-pneumonia by mincing a "tumour" produced by subcutaneous inoculation, mixing with three volumes of normal saline and, after keeping in the cold store overnight, adding either one half or one per cent. commercial formalin to the mixture after it had been strained through muslin. The material so prepared was kept at 1° C. for 22 hours, and then used for inoculation. Ten animals were used, and the doses ranged from 5 c.c. to 50 c.c. In the case of doses of from 5 to 20 c.c., three injections were given at intervals of a week. Doses of 25 to 35 c.c. were injected twice, and doses of 40 to 50 c.c. were given once only. No reaction followed the injections. Three weeks after the last dose, 5 c.c. of slightly attenuated culture (5th to 7th subculture) were injected subcutaneously. Five animals reacted severely, two gave marked reactions and two failed to react. The first generation of the strain of culture used produced severe reactions in all cases with some fatalities.

YAMAGIWA, S., ITABASHI, K., and ITO, S. (1930.) **Studies on Contagious Pleuro-Pneumonia in Cattle. I. On the Practical Value of the Complement Fixation Test Applying the Virus Culture as Antigen in the Diagnosis of Contagious Bovine Pleuro-Pneumonia.** *Select. Contrib. Mukden Inst. Infect. Dis. of Animals.* 1. 225-226. [From English Summary.]  
 ———. **II. On the Correlation among the Morbid Changes of Lungs, the Cultivation of Virus and the Complement Fixation in Cases Naturally Infected.** *Ibid.* pp. 227-228. [From English Summary.]

I. Mongolia is the centre of epizootics of contagious bovine pleuro-pneumonia in the Far East. The authors carried out complement-fixation tests with the blood of cattle. They slaughtered and examined carefully 57 natural reactors, 160 non-reactors and eight experimentally infected cattle which were reactors, and attempted to cultivate the virus from all of them.

Infected cattle continued to give positive reactions for "a long period." Apparently healthy animals in which there was only a small lesion gave positive reactions.

The 160 non-reactors, 18 of which were tested 2-50 times, were free from infection, but some positively reacting infected animals became non-reactors when observations were continued, and in some cases reactions were inconstant when repeated at intervals. Fourteen of the 57 reactors were free from infection.

The disease ran an acute course in four out of the eight experimentally infected animals, and they died in 20 days. It ran a chronic course in the other four, but no lesions were found in the lungs. Weekly tests of the acute cases yielded positive reactions, and the organism was cultivable from the peripheral blood in the last ten days of life.

II. The authors tentatively classified lung lesions into initial, advanced and sequestral types, and correlated the results obtained with the complement-fixation test and with cultivation of the virus from animals with each type of lesion.

Of 13 cases with the initial type of lesion, positive reactions to the complement-fixation test were obtained in eleven and strong positive reactions in two. Of 22 cases with the advanced type of lesion, strongly positive reactions were obtained in 21 and the reaction was weakly positive in the other.

Of 38 cases with the sequestral type of lesion, strong positive reactions were obtained in 22, weak positive reactions in four, and indefinite reactions in twelve. The authors consider that the reaction becomes more marked with the progress of the disease until it fades away in the chronic cases.



Virus was cultivated from each animal out of 14 with the initial type of lesion, from 19 out of 20 with the advanced type, and from 27 out of 34 with the chronic type [presumably from material obtained at autopsies].

POOL, W. A., BROWNLEE, A., and WILSON, D. R. (1930.) **The Etiology of "Louping-ill."** *Jl. Comp. Path. & Therap.* **43.** 253-290. [With 3 tables.]

The etiology of "louping-ill" has hitherto been disputed. The disease causes enormous losses on hill sheep farms in certain parts of Scotland and the North of England. Its very definite distribution, the seasonal incidence, and the fact that acclimatised sheep are more resistant than sheep from farms on which it is unknown, indicate that it is probably an infective disease.

The authors report the isolation of an infective agent from the central nervous system of two natural cases of "louping-ill," and that they were able to pass it in series through over a hundred sheep and pigs involving passage through 16 generations. All attempts to isolate micro-organisms from the tissues of affected animals, or to demonstrate the presence of bacteria or protozoa, yielded negative results. Healthy sheep, kept in close contact with inoculated sheep in all stages of the disease, remained healthy. Certain filtration experiments carried out, yielded negative or inconclusive results, but they were not completed. The infective agent is probably present in the brains of all affected sheep during the early stages of the disease. In the experiments recorded it was usually, but not constantly, present in the mesenteric and popliteal lymphatic glands and in the spleen. It was usually present in the blood at some stage of the infection, but was apparently absent throughout the whole course of illness in at least one instance. It was not demonstrated in cerebro-spinal fluid, aqueous humour, bone marrow, liver or skin. Infection was produced with suspensions prepared from brain tissue by intracerebral, intraspinal, intrasciatic, intra-ocular, intravenous and subcutaneous inoculation and by supra-ocular instillation. Negative results were obtained from intramuscular, intradermal and endermic inoculation, from intranasal instillation and from administration *per os*.

The infective agent was viable in 50 per cent. glycerol for at least 82 days. It resisted exposure for three hours at 20° C. to 1 per cent. phenol, 0.005 per cent. sodium hydrate and 0.001 per cent. copper sulphate. It was destroyed by similar exposure to 0.5 per cent. formal, 0.05 per cent. sodium hydrate, and 0.01 per cent. copper sulphate. It resisted exposure for one minute to a temperature of 60° C., and was destroyed by exposure for five minutes or more.

WALKER, J. (1930.) **East African Swine Fever.** *Ann. Rpt., Dept. Agric., Kenya.* pp. 366-375. Nairobi: Govt. Press. [8vo.]

This paper records the continuation of experiments connected with the preparation of a vaccine and of an anti-serum, and immunisation by the serum-simultaneous method.

Spleen pulps were treated with formalin in various proportions of 1 in 1,000 to 1 in 100, and periods ranging from 13 to 24 days were required for inactivation. An attenuated virus produced swine fever reactions in 33 per cent. of the pigs vaccinated, and half of these died. The non-reactors, when tested with a more active virus, reacted and there was some mortality. An attempt was made to attenuate the virus in spleen pulp and in blood, without inactivating it, by various strengths of formalin from 1 in 1,000 to 1 in 100, exposing the mixture to a temperature of 1° C. for 48 hours. The mixtures produced indefinite reactions and, when the immunity was tested with active virus, reactions took place but recoveries followed. The information obtained from the small number of experiments performed would seem to indicate that a suitable degree of attenuation without inactivation, is achieved by adding formalin in the proportion of 1 in 500 to spleen pulp plus saline. This confers protection against attenuated virus.

It has been found possible to produce a hyperimmune serum by injecting recovered pigs intraperitoneally with citrated virulent blood at the rate of 5 c.c. per lb. body weight, and bleeding 14 days later.

This serum was found to be effective for serum-simultaneous inoculation, and also for the serum-contact method of producing immunity.

TWORT, Frederick William. (1930.) **Filter-passing Transmissible Bacteriolytic Agents (Bacteriophage).** *Lancet*. November 15th. pp. 1064-1067.

This paper is written at the invitation of d'Hérelle in order to "relate circumstances which determine those differences, and to explain a little more fully a few facts given in my first paper which may have been overlooked or not fully understood, in the hope that other workers will then be in a better position to appreciate their significance." The "first paper" referred to in the foregoing quotation is one published in the *Lancet* of December 4th, 1915, in which the author "gave a broad description of the filter-passing transmissible bacteriolytic agents, now frequently described under the name of 'the bacteriophage.'" The "differences" referred to in the quotation may perhaps best be indicated by another quotation from the present publication. "It has been suggested that the active agent, described by d'Hérelle under the name 'the bacteriophage,' differs from the agents which I described in my original paper. Although nearly 15 years have elapsed since my first publication, this view is still sometimes put forward, and appears to be based, partly at least, on a very narrow and critical interpretation of a few words and sentences in my paper."

### DISEASES CAUSED BY METAZOAN PARASITES.

SCHWARTZ, Benjamin, and ALICATA, Joseph E. (1930.) **Species of the Nematode Genus *Strongyloides* Parasitic in Domestic Swine.** *Jl. Agric. Res.* 40. 11-23. [With 12 figs.]

As stated in the authors' introduction, the object of this paper is to clear up the existing uncertainty in the specific identity of nematodes of the genus *Strongyloides* parasitic in domestic swine. The relevant literature is reviewed, and the opinion that the swine and sheep forms are identical is signified to be the one most generally held. The examination of parasitic females collected at the autopsy of young pigs in Bethesda, Md. showed them to differ in several respects from *S. papillosus* of sheep, and also from the figures and descriptions of *S. suis* published by investigators in Europe. Some badly preserved specimens collected at Moultrie, Ga., appeared to possess the acutely pointed tails typical of the forms described by European writers, and it is probable that two distinct species occur in American pigs. For the first of these species the name *S. ransomi* is proposed, the name *S. suis* being at present retained for the forms with acutely pointed tails. Descriptions are given of the parasitic and free living generations of *S. ransomi*, and comparisons are made with *S. papillosus*, the most notable morphological difference being seen in the tail of the parasitic female which in *S. papillosus* is rounded and finger-like, and in *S. ransomi* is cone-shaped and tapers gradually to its tip. A biological difference is also recorded, the rabbit being susceptible to infection with *S. papillosus*, but apparently resistant to *S. ransomi*. The shape of the tail and the position of the vulva of the parasitic female, as gathered from figures and descriptions of the European form, show it to be distinct from *S. ransomi* and *S. papillosus*, and it is thought advisable for the present to retain the name *S. suis* to designate this form.

SCHWARTZ, Benjamin, and ALICATA, Joseph, E. (1930.) **Two New Species of Nodular Worms (*Oesophagostomum*) Parasitic in the Intestine of Domestic Swine.** *Jl. Agric. Res.* 40. 517-522. [With 12 figs.]

On making a study of a small collection of oesophagostomes obtained from domestic swine in Georgia, the authors came across two new species. The first of these, named *O. brevicaudum*, was present in fairly large numbers; the determinate characters are the relatively large number of elements in the leaf crowns, and the short tail and long vagina of the female, which differentiate it from both *O. dentatum* and *O. longicaudum*; dissimilarities are also described in the walls of the buccal capsule as seen in optical section. The second new species, named *O. georgianum*, was only represented by six specimens. It bears a close resemblance to *O. dentatum*, the principal differences being in the shape of the gubernaculum, and in the tail of the female which is relatively short and of a distinctive shape. The view that the six specimens assigned to *O. georgianum* may be aberrant forms of *O. dentatum* is acknowledged by the authors, who hold the opinion, however, that the difference between the two forms warrants the recognition of two distinct species.



TAYLOR, E. Leonard. (1930.) **The Third Stage Larva of *Strongylus equinus*.** *Ann. Trop. Med. Parasit.* **24.** 545-561. With 6 text figs. [18 refs.]

The uncertainty of present knowledge on some aspects of the life history of the strongylid parasites of the horse is principally due to this animal's relatively large size, which increases the difficulty of the search for microscopic forms. The author therefore carried out feeding experiments on guinea-pigs, using for most of the trials the infective stage of *Strongylus equinus*. This species is of less frequent occurrence than the other two species of *Strongylus*, but it was principally used in these experiments because it was found to be more easily cultured. In the examination of 25 experimentally fed guinea-pigs, three forms of larvæ were encountered. A form which is referred to as "Larva A" appeared to be the earliest; this was found in the mucosa of the wall of the large colon close to the cæcum. "Larva B," regarded as the mature third stage larva, was found in the mucosa of the large colon, in the ileocæcal lymphatic glands, and in the liver. Only one representative of a later stage was found, and it is regarded as a fourth stage larva; evidence of its movements was seen in white tortuous tracks on the diaphragmatic surface of the liver.

A short description of these larval forms is given, and their development in the experimental host is summarised as follows:—a few of the ingested larvæ which are able to free themselves from their sheaths penetrate the mucous membrane of the first part of the large colon, following which one of three things may happen:—(i) the larva may remain unchanged in the intestinal wall for a period which in one instance extended over 23 days; (ii) still remaining in the intestinal wall, the larva may develop to stage "B"; (iii) the larva may pass through the gut wall and enter either the blood stream or the lymphatics, but it does not wander free in the peritoneal cavity. Occasional larvæ reaching the liver by the blood stream may develop as far as the fourth stage. It is thought that the wanderings of the larvæ thus observed in the guinea-pig are probably similar to those which occur in the horse.

VON SCHUCKMANN, W., and ZUNKER, M. (1930.) **Zur Entwicklung der Schweine-Lungenwürmer. (On the Development of the Lungworms of Swine.)** *Zeitschr. f. Infektr. d. Haust.* **38.** 233-246. [11 refs.]

The work of these authors confirms that of A. and M. HOBMAIER; the names, *Lumbricus terrestris major* and *Lumbricus terrestris minor*, used by the discoverers, do not, however, appear in Ude's systematic treatise, and it is not certain to which species they referred. In the work here recorded, very heavy experimental infections were obtained in *Eisenia fetida* (Savigny, 1826); natural infection was observed in *Lumbricus rubellus* (Hoffmeister, 1843); *Lumbricus terrestris* (L., 1758) and *Allobo-phora caliginosa* (Savigny, 1826) were found to be only poor hosts, the majority of larvæ dying; and *Bimastus tenuis* (Eisen, 1874) resisted infection altogether. The migration of the lungworm larvæ in the earthworm was studied by means of sections, the cutting of which was facilitated by placing the infected earthworms in moist blotting paper for some time beforehand. The worms ate the paper, and so cleared their intestines of soil and made section cutting possible.

In addition to clearing of soil from worms already infected, this medium was used in some instances to produce the infection, the nematode larvæ being placed in the blotting paper. The lungworm larvæ do not stay in the wall of the œsophagus of the earthworm, but quickly pass through to gain the blood vascular system and migrate to the various vessels. In very heavily infected earthworms, larvæ may occasionally find their way to the body cavity, but they have not been observed in the musculature, in the genital organs, or in the excretory organs. In ten to twelve days after the infection of the earthworm the larvæ moult, after which they become infective for swine. The first stage larva can easily be distinguished by its button-like posterior extremity which the second stage larva does not possess; the intestine of the second stage larva has a gold brown colour which, in the course of time, becomes fainter, and in six and a half weeks is colourless. Infective larvæ liberated into the soil by death and decay of the earthworm are very resistant, and may remain alive for long periods.

Wanderings of larvæ in the final host were studied by feeding experimentally infected *Eisenia fetida* to swine. Five days after the experimental feed, larvæ were found in the lymph glands of the colon, some having already undergone a second moult and being recognisable as males and females. The lymph glands of the cæcum and small intestine contained very few larvæ, none of which had

undergone the second moult. The lungs showed numerous small hæmorrhages caused by lungworm larvæ which were recognisable as males and females, but no trace of larvæ could be found in the liver. Findings in a pig killed seven days after the experimental feed were essentially the same, and no indication of a further moult was observed. In a pig killed 16 days after the experimental feed, female worms containing eggs and presenting recognisable specific characters, were found in the lung but there was still no sign of a further moult. 150 naturally infected *Lumbricus rubellus* were fed to a pig which, when killed in ten weeks time, was found to have acquired a moderately heavy infection of *M. elongatus*. Although the fæces of the pig had been examined from the fourth week after the infective feed, and the tracheal mucus was examined after death, neither eggs nor larvæ were found. The worms recovered had only grown to between  $2\frac{1}{2}$  and 3 cms., and may have been too young to reproduce, although eggs containing larvæ were found to be present in the uteri.

SCOTT, J. Allen. (1930.) **Further Experiments with Physiological Strains of the Dog Hookworm *Ancylostoma caninum*.** *Am. Jl. Hyg.* **11.** 149-158. [6 refs.]

Experimental demonstrations of two physiological strains of *Ancylostoma caninum*, one of which is peculiarly adapted to the dog and the other to the cat, have previously been reported by the author who here gives an account of attempts to ascertain something of the nature of the difference between the two strains. Experiments were planned to find out whether one or more generations spent in the least favourable host would change the host preference of the two strains, and whether the two strains would interbreed. After three generations in cats, the dog strain appeared to have undergone no change and still remained peculiarly adapted to cats: but the cat strain, although at the first passage hardly establishing itself in the dog, appeared after one generation in that host to have changed its nature, and become better adapted to dog than cat. Circumstances unfortunately prevented the repetition of this experiment. Adult worms of each strain were successfully transferred from one species of host to another by securing them at autopsy of the favourable host and immediately administering them in a gelatine capsule to the unfavourable host. No difference could be demonstrated between the susceptibility of the dog and cat in relation to this transfer of the adult worms of the two strains, but for some undetermined reason, great variation occurred in the different transfers between the number of immature worms which became established.

Experiments on the crossing of strains unfortunately had to be discontinued at an early stage, but the few females which were old enough to reproduce did not contain fertile eggs and the development of the sexual organs of many appeared to have been retarded.

ONO, Sadao. (1930.) ***Gymnopleurus sinnatus* as the Intermediate Host of *Spiruridæ* found in the Vicinity of Mukden, South Manchuria. I. Inquiry into Grassi's Experiment with *Blatta orientalis*.** *Select. Contrib. Mukden Inst. Infect. Dis. of Animals.* **1.** 233-237.

Forty-seven of 400 dung beetles belonging to the species *Gymnopleurus sinnatus* were found to be infested with several species of spirurid larvæ. In order to determine whether *Spirocerca sanguinolenta* was represented, feeding experiments were carried out on two dogs which were kept in the laboratory for two months before being used. These dogs received two infective feeds, 51 and 11 days respectively, before they were killed. At autopsy, larval and immature forms of *S. sanguinolenta* were found in the wall of the aorta, and adults were found in œsophageal tumours, the latter doubtless being the result of infection acquired before the experiment began. The production of aneurisms in the aorta is thought to be due to the reduction in its elasticity as a consequence of the rupture of the elastic lamellæ which the author observed on the examination of sections.

In two normal rabbits, which received experimental feeds of infected dung beetles between eight and one days before being killed for examination, the development of spirurid larvæ in the outer wall of the stomach was observed, but no larvæ were found in the aorta. In a third rabbit, which had been fed on a diet containing lanolin, and which received infective feeds between 44 and 38 days before autopsy, *S. sanguinolenta* larvæ were found to have developed in the aorta. In a fourth rabbit, which had been fed on a diet containing lard, and received infective feeds between 135 and 121 days before autopsy, aneurisms were found in the aorta, but no larvæ. It is thought that the natural resistance of the rabbit to infection with *S. sanguinolenta* may be partially overcome by



giving quantities of lard or lanolin, but the larvæ which are able to establish themselves in the aorta die within a period of four months. The author points out that the work of SEURAT (1912) and of FAUST (1927) supports his conclusion that the spirurid larvæ described by GRASSI (1888) were not those of *Spirocerca sanguinolenta*.

WETZEL, Rudolf. (1930.) **On the Biology of the Fourth Stage Larva of *Oxyuris equi* (Schränk).** *Jl. Parasitol.* 17. 95-97. [With 1 fig. and 5 refs.]

The fourth stage larva of *Oxyuris equi* which up to the present time has been thought to live free in the cæcum and colon, has been observed by the author to be attached to the mucous membrane in the freshly opened and still warm intestine. By means of longitudinal and transverse sections a close study was made of its mode of attachment to the bowel wall, and it was observed that a portion of the superficial stratum of the mucous membrane was drawn into the cup-shaped dilatation of the anterior part of the œsophagus which serves as a mouth capsule to the larva.

The mucous membrane at the point of attachment was observed to be superficially injured, and isolated tissue cells were traced to the gut of the larva which presumably utilizes those cells, along with tissue juices, as food. It appeared that the position of the larvæ had been frequently changed, as injuries to the mucous membrane could be seen in many places, while the mucosa and submucosa in the neighbourhood showed a round cell infiltration. As, however, in the cases studied large numbers of strongylids were also present, the *Oxyuris* larvæ may not have been responsible for all the changes observed.

MOENNIG, H. O. (1930.) **Studies on the Bionomics of the Free-living Stages of *Trichostrongylus* Spp. and other Parasitic Nematodes.** 16th Rpt., *Direct. Vet. Ser. and Anim. Indust. Union of S. Africa.* pp. 175-196. [54 refs.] Pretoria: Govt. Printer.

It is found that lambs, free from parasitic infestation, can be bred by keeping sheep in small gravelled paddocks. The lambs born at the beginning of the dry winter at Onderstepoort are almost always free from infection until the rains start in the spring.

In other cases, since sheep at the Onderstepoort Laboratories rarely have worms other than *Hæmonchus*, *Oesophagostomum*, *Trichostrongylus*, and *Strongyloides*, infected lambs were treated to expel the worms, and then kept on sawdust in stables which were cleaned without water twice weekly. *Strongyloides* infestations were disregarded.

To obtain pure cultures of *Trichostrongylus*, faeces of sheep containing eggs of different species are incubated for 18 hours at 37° C., dried, and then moistened again. After this treatment only *Trichostrongylus* larvæ develop in them.

Infestation of a lamb with *O. columbianum* was achieved by administering, by way of the rectum, worms from a sheep just slaughtered. They were passed as far as possible into the colon by means of a rubber tube with a funnel attached, the lamb in the meantime being held up by the hind legs.

In the first experiments the effects of cold were tested upon the eggs and pre-infective larvæ of *Trichostrongylus*, then the effects of dryness, temperature, and immersion in water were investigated. The effects of these conditions were then tested upon infective or mature larvæ. Experiments were carried out to check the diversity of opinion that has been expressed with regard to the powers of migration of larvæ. It was found that they do migrate, provided the conditions of diffused light, temperature, and consistence of the culture medium are correctly observed. Migration does not occur from a culture medium that is too wet, as surface tension prevents escape.

The period during which vitality is retained in the soil was tested by means of the Baermann apparatus.

In dry cold weather, development is slow, and drying proves fatal to eggs and larvæ before they reach the infective stage.

Some of the eggs of *Trichostrongylus* which contain fully-formed embryos will resist drying, but the pre-infective stages of *Hæmonchus contortus* and *Oesophagostomum columbianum* are killed by drying.

High temperatures (37° C.) cause rapid preliminary development of *Trichostrongylus* followed by deterioration and death. Development does not take place in eggs under water, but the eggs

of *Trichostrongylus* and *Hæmonchus* remain viable under water for about six weeks. Freezing for a period of ten days does not prevent infective larvæ of *Trichostrongylus* from infecting lambs. Infective larvæ of this species can also resist drying for long periods and have revived after being dried on glass slides for eight and a half months. *H. contortus* and *O. columbianum* larvæ survived only about half that length of time.

Under natural and favourable conditions in soil, the larvæ survive for periods up to three months. Persistence of conditions favourable to migration kill the larvæ by exhaustion in a short time.

Infective larvæ of *Trichostrongylus* are not skin penetrators.

ONO, Sadao. (1930.) **The Life History of *Prosthogonimus putchkowskii* found in the Vicinity of Mukden, South Manchuria. I. *Anax parthenope* as the Intermediate Host and Infestation Experiment with Male Fowl.** *Select. Contrib. Mukden Inst. Infect. Dis. of Animals.* 1. 299-231. [With 7 figs.]

On the examination of 100 dragon flies belonging to the species *Anax parthenope*, the author found 30 trematode larvæ which, with one exception, were present in the body cavity. The larvæ are stated to have the distinctive feature of an exceptionally thick cyst wall, such as has not previously been observed in any trematode. About 300 dragon flies of three other species were dissected, but the only larvæ found were enclosed in a thin cyst wall and presumably belonged to another species. A chicken which received 20 larvæ with a thick cyst wall began to pass eggs of *P. putchkowskii* 23 days afterwards, and ten adult worms were recovered from the *bursa fabricii*; these worms are described. Larvæ enclosed in cysts with thin walls which had been collected from the other species of dragon fly were fed to two chickens, but without any resulting development of adult worms.

RICHTERS, E., and FRISCHBIER, A. (1930.) **Die Bekämpfung der Sklerostomiasis des Pferdes vom Standpunkt der Hygiene und Therapie. [The Control of Sclerostomiasis in Horses from the Hygienic and Therapeutic Standpoint.]** *Berl. Tier. Woch.* 46. 493-502. [20 refs.]

This paper issues from the special section of the Army Veterinary Research Department which is charged with the investigation of parasitic diseases. As the section has been at work for two years only, complete results have not been obtained.

It has been found that there is, as a rule, a rapid fall in the degree of infestation with parasites after horses are four years old, and that infestation remains practically constant in horses from six or seven to ten years of age. The authors have not been able to detect any difference in the intensity of parasitic invasion at different times of the year, and it has not been possible to distinguish the eggs of sclerostomes from those of trichonemes. The larvæ of the latter are said to have longer tails than those of the former when they are hatched out. In an investigation of the effects of weather upon larvæ, some fæces were kept in the open air from February, 1929, when the temperature was from 25 to 20 degrees below zero C., until June, 1930. They were then mixed with water and, after incubation at 28° C., living sclerostome larvæ were obtained.

The authors' experiments support the views expressed by MAGNIN, ALBRECHT, NOELLER and SCHMID that dry food-stuffs contaminated with larvæ are a source of infection. Water, provided it contains organic materials, may also serve as the vehicle for infection. Larvæ rapidly die in pure water.

Direct observation has been made of the passage of larvæ up moist blades of grass, and their return to the ground when the grass is exposed to the sun and the moisture on the surface of the blades or stalks dries up.

In stables, larvæ could be found on moist walls which were contaminated with fæces, but dry walls which had been thoroughly lime-washed, appeared to be free from them. In experiments designed to test the effects of certain chemicals on the eggs and larvæ, it was found that milk of lime was definitely effective, but only if the fæces and the solution were very intimately mixed so as to achieve close contact between the disinfectant and the parasites.

By placing fæces in the dung heap underneath layers which have already become disintegrated, larvæ and eggs can be completely destroyed by the heat generated. The authors have registered a temperature of 70° C. in the interior of a well-packed dung heap. Details are given of a number of



experiments carried out to test the value of a number of substances as anthelmintics, some of them being proprietary drugs. The authors do not appear to have arrived at any definite conclusion as to the comparative merits of these drugs. A treatment combining intravenous injections of tartar emetic with administration of the same drug *per os* is said to show promising results. This course of treatment lasts three weeks.

NAGATY, H. F. (1930.) *Trichostrongylus capricola* Ransom, 1907, from the Goat in England. *Ann. Trop. Med. Parasit.* **24**, 423-424.

A report is given on the finding of *Trichostrongylus capricola*, and it is thought to be the first record of its occurrence in Great Britain, *T. colubriformis*, *T. vitrinus* and *T. extenuatus* being the only species previously recorded in British ruminants. The determination was confirmed by comparison with co-types from the U.S. Bureau of Animal Industry.

[MORGAN (1930) reports *T. capricola* to be very common in British goats.]

WRIGHT, Willard H. (1930.) *The Incidence of Internal Parasites in Dogs at Washington, D.C.* *Jl. Amer. Vet. Med. Ass.* **76**, 794-803.

The examination of 150 dogs at Washington, D.C., during the course of anthelmintic investigations, showed 96.7 per cent. to be carrying parasitic worms, the incidence of the various species found being as follows:—*Rossicotrema venustus* was the only representative of the trematodes, and occurred in 5 per cent. of the dogs. *Dipylidium caninum* was the most prevalent cestode, and occurred in 68 per cent. of the dogs, the only other species being *Tænia pisiformis*, which occurred in 8.7 per cent. Of nematodes, *Toxocara canis* occurred in 33.3 per cent., and *Toxascaris limbata* in 10 per cent.; the only species of hookworm found was *Ancylostoma caninum*, which occurred in 50 per cent. Whipworm proved to be the parasite of most common occurrence, and was found in 81 per cent. The eggs of *Hepaticola hepatica* were found in the livers of two dogs. The author makes a comparison between the incidence of parasites found in this series of dogs, and the incidence of the same parasites as recorded by other investigators in groups of 76 dogs in 1917, and of 50 dogs in 1896; it is pointed out that *Rossicotrema* was not found by the previous recorders, and that the prevalence of *Dipylidium* and *Trichuris* has increased, but no explanation can be offered for these changes. The incidence of *Tænia* is shown to have decreased, which may be explained by improvements in the disposal of slaughterhouse offal. Ascarids and hookworms are shown to have increased from 1896 to 1917, and then to have decreased, a reason for which is suggested in the introduction of reliable anthelmintics.

LE ROUX, P. L. (1930.) *A Preliminary Communication on the Life Cycle of Cotylophoron cotylophorum and its Pathogenicity for Sheep and Cattle.* 16th Rpt., Direct. Vet. Ser., and Anim. Indust. Union of S. Africa. pp. 243-253. [7 figs., 16 refs.] Pretoria: Govt. Printer.

Two serious outbreaks of paramphistomiasis among sheep in the Orange Free State are here reported. A loss of approximately 30 per cent. was sustained in one flock of 275 sheep, and in another flock numbering 300, the loss was as high as 50 per cent. A small pool on the site of one outbreak was found to harbour thousands of snails belonging to a species of *Bulinus*. In the second outbreak there was circumstantial evidence to suggest that the snails had been originally infected by cattle. It is only when the young flukes are present in the duodenum that they cause disease, and after their migration to the rumen the affected host recovers. The symptoms, which are not characteristic, are similar to those of fascioliasis and verminous gastro-enteritis; loss of condition was noticed by the owner of one flock 16 days after sheep entered the infected pasture. The most noticeable pathological change is seen at autopsy in the first 4 or 8 ft. of the small intestine, where there is an engorgement of the blood vessels on the peritoneal surface and a thickening of the intestinal wall, particularly of the mucous membrane. Data gathered suggest that development of this parasite in the final host is slow, and that six to eight weeks are spent in the small intestine, while another

eight weeks may be required before eggs are passed. Beneficial results were obtained by treatment with carbontetrachloride, but only when administered in doses of 8 to 10 c.c. in linseed oil. From descriptions seen in the literature, the author thinks that the sheep disease known as "Gillar" which occurs in India, is probably paramphistomiasis, and that the two will eventually prove identical.

**TAYLOR, E. Leonard. (1931.) Some Significant Points Concerning the Parasitic Worms of Fowls and the Causation of Worm Diseases. *Vet. Jl.* 87. 28-32.**

This paper is a short discussion of helminthiasis as distinct from the helminths themselves. During the evolutionary period in which host and parasite have been associated with one another, a progressive mutual adaptation has been going on which is now almost complete. The perfect "parasite," using the term in a broad sense, does not harm its host, as by so doing it would destroy its own source of existence, and it is not unreasonable to suppose that in early times the wild jungle fowl lived in comparative harmony with its parasites. The man-made conditions of unnatural crowding have upset this balance and worm diseases are now common. These diseases are peculiarly associated with crowded conditions because, unlike diseases caused by bacteria or protozoa, every individual worm parasite must find its way from the exterior into the body of the host; on account of which the rate of infection in helminthiasis theoretically increases as the square of the number of fowls kept per unit area. It is evidently true of many parasitic worms that, while the presence of large numbers causes disease, the presence of a few does not; but in most instances we know little or nothing of the numbers which may be carried with impunity and the numbers which produce disease, or of the other factors concerned. A short account is given of what is known of disease production by *Ascaridia lineata*, *Heterakis gallinæ*, *Syngamus trachea*, and *Davainea proglottina*.

**BRAILS福德, J. F. (1931.) Hydatid Disease in England (British Institute of Radiology). *Lancet*, January 24th. pp. 185-186.**

The author of this paper disagrees with the general opinion that hydatid disease is rare in England, although much less prevalent than in many other countries. From daily observations carried out at the Birmingham public abattoir he was able to gather a fair idea of the frequency of its occurrence in sheep, cattle and pigs. That nothing is being accomplished in the way of eradicating this formidable disease is also shown by the persistence of hospital cases.

With reference to diagnosis, particular mention is made of the use of X-rays, which often gives the first indication of the disease. If in the lung, it might be mistaken for tuberculosis, but the absence of lung changes at the circumference of the cyst suggests hydatid disease. An important obstacle to the control of this disease is the difficulty of tracing the origin of human infections as, owing to the slow growth of the cyst, it may be present for ten years before suspicion is aroused. Active measures directed at the control of dogs in Australia have resulted in a decrease in the incidence of the disease, and the author thinks that steps ought to be taken towards its eradication from this country: as initial control measures, he suggests enforcing the prohibition of dogs from slaughterhouses, the compulsory notification of all cases of hydatid disease [in the human subject?], the inspection of farms, and the publication of educational pamphlets.

**LEWIS, E. Aneurin. (1930.) An Account of a Survey of the Parasitic Helminths of Some Domestic Animals in Mid-West Wales. *Jl. Helminth.* 8. 1-18. [With 7 tables and 5 refs.]**

This paper gives a detailed account of parasites obtained in examinations carried out over a period of four years on some domestic animals in the Cardigan County district of Wales. During the survey, 668 sheep, 48 cattle, 62 pigs, 78 chickens, 42 ducks, 10 geese, 15 pheasants and 4 guinea fowls were examined. The main part of the paper deals with the parasites of sheep, but no definite conclusions are reached, and the author expresses the opinion that it will first be necessary to carry out the examination of more animals over a longer period of time. The following are some of the most notable observations:—helminths were found in 95.2 per cent. of the sheep; *Moniezia* was observed to be most prevalent in May, there being a fall in the proportion of infected lambs in June,



followed by a temporary rise from July to October, which observation confirms that reported by MORGAN in 1925. Next to *Trichuris ovis*, *Monodontus trigonocephalus* was found to be the most common parasite, and it occurred in 55.8 per cent. of sheep. In contradistinction to the trichostrongyles of the fourth stomach, this species is more common in adult sheep than in lambs. *Ostertagia circumcincta* was observed in very large numbers in some individual lambs, but no infestation resulting in death was observed. *Hemonchus contortus* occurred less frequently and in smaller numbers than *O. circumcincta*. *Muellerius capillaris* was found to be the most common parasite of the lungs of sheep. Of the parasites of cattle, *Fasciola hepatica* was the most prevalent, occurring in 42 of the 48 animals examined; in most instances it was present only in small numbers, but two fatal infestations were observed. The most common parasites of pigs were found to be *Metastrongylus elongatus* and *M. brevivaginitus*. A light infestation with *Fasciola hepatica* was observed in eight pigs. Of the 78 chickens examined, five only were found to be free from helminthic infection; 91 per cent. harboured *Heterakis vesicularis*. *Syngamus trachea* was very common, and caused serious losses. *Davainea proglottina* and *Ascaridia lineata* appeared to be comparatively scarce. Adult pheasants were found to be harbouring *Syngamus*.

TAYLOR, E. L. (1930.) *Liponyssus sylviarum* Injuring Poultry in This Country. *Parasitology*. 22. 313.

The author was able to find only one previous record of the occurrence of this mite in fowls in Great Britain. The outbreak of disease which is here reported occurred at Dorchester where the mites were found in large numbers and in all stages of development in the feathers of the affected fowls, but none were seen on the eggs, in the nests, or in other parts of the poultry houses. In this particular the observation is at variance with that of CUTRIGHT (1929), who records an outbreak in New York, where the presence of large numbers of mites on the hens' eggs was the first indication of infection. Painting the perches with nicotine sulphate, as successfully used by CUTRIGHT, was tried and found to be an effective treatment.

BEDFORD, G. A. H. (1930.) New Genera and Species of Mallophaga from South African Hosts. 16th Rept. Direct. Vet. Ser. & Anim. Indust. Union of South Africa. pp. 153-170. Pretoria: Govt. Printer.

The parasites figured and described by the author are as follows, but for details of description the original must be consulted.

Super-family *Amblycera* Kellog.

Family *Menoponidae* Mjöberg.

Genus *Allomenopon* nov.

Genus *Psittacomenopon* nov.

Genus *Menacanthus* Neumann.

*Menacanthus corvus* nov. sp.

Genus *Machærilæmus* Harrison.

*Machærilæmus urocolius* nov. sp.

Genus *Colpocephalum* Nitzsch.

*Colpocephalum ferrisi* nov. sp.

Genus *Eucolpocephalum* nov.

*Eucolpocephalum robustum* nov. sp.

Super-family *Ischnocera* Kellog.

Family *Trichodectidae* Burmeister.

Genus *Tricholipeurus* Bedford.

*Tricholipeurus lerou* XI nov. sp.

Genus *Lipeurus* Nitzsch.

*Lipeurus waterstoni* nov. sp.

Genus *Colilipeurus* nov.

Genus *Naubates* nov.

*Naubates harrisoni* nov. sp.

*Naubates pterodromi* nov. sp.

—(1930.) Recent Developments in Blowfly Research. *Jl. Sci. & Indust. Res., Australia*. 3. 212-219.

This article was written by the Division of Economic Entomology, Council for Scientific and Industrial Research, Australia. It is merely descriptive of certain fundamental conceptions that relate to the blowfly problem and does not deal with the whole of the work in progress.

Probably no single problem is regarded by Australian primary producers as of equal importance, and no single source of loss as great as that caused by blowfly attack on sheep. The monetary loss has been computed at £4,000,000 *per annum*, and this is not too high. Approximately  $3\frac{1}{2}$  per cent. of the cost of wool production in Australia is due to the activities of the blowfly.

Seven species of flies have been bred from living sheep, but they are not all of major importance. Descriptions are given of *Lucilia sericata* and of *Chrysomyia rufifacies*.

*L. sericata* is an old-world species which has gradually been dispersed through the agency of man. In Great Britain it is the only species that attacks sheep. In Australia it is present wherever there is a serious blowfly problem. The history of the development of the problem in Australia is exactly what would be expected from the increase and spread of an introduced pest. There is no blowfly problem in the Fitzroy River district and *L. sericata* is absent.

This fly is the first to arrive at a carcass and to lay its eggs, being stimulated by a very early stage in decomposition. The fermentative processes which go on in wool, particularly if wet or soiled, probably have a greater attraction for it than for other species. *Lucilia* is not bred from sheep in such large numbers as might be expected because its larvæ soon become crowded out by those of the more robust species.

The brown blowflies (*Calliphora stygia* and *C. augur*) can probably infest only a very small percentage of a flock when alone, but are more important when *Lucilia* has cleared a way for them.

The problem presented by *Chrysomyia* is much more interesting. Its larvæ are known to devour other larvæ, and some have considered that it is therefore useful, while others have believed that it causes more damage to sheep than to the other blowflies. Experiments with carrion have shown that *C. rufifacies* does not lay its eggs until some change has been produced in the medium by *Lucilia* or *Calliphora* larvæ, and that *Chrysomyia* larvæ only mature normally on a mixed diet of altered tissues and living maggots.

An account is given of the succession of flies and beetles that utilise a carcass, each taking advantage of the appropriate conditions with regard to the presence of other larvæ and the stage of decomposition to suit its requirements; and an account is also given of those which attack the various larvæ and pupæ.

Emphasis is laid on the importance of this biological complex when steps are taken to destroy either of the flies. For *Lucilia* destruction, material in the first and early part of the second stage of decomposition must be available. There is an enormous surplus of blowflies for the available food material. Destruction of only a proportion of the population helps the existing adults by eliminating the normal fierce competition for existence and leaving more food for the survivors. With the normal life of these flies and their capacity for flight, the carcass of a single sheep may, during the spring and autumn months, produce enough *Lucilia* effectively to search over about 30 square miles for means of existence for the next generation. During these months the actual concentration of *Lucilia*, in eastern New South Wales, apart from the other species, is probably of the order of 100,000 to the square mile.

## DISEASES RELATED TO NUTRITIONAL AND METABOLIC FACTORS.

PAPPENHEIMER Alwin M., and GOETTSCH Marianne. (1931.) **A Cerebellar Disorder in Chicks, apparently of Nutritional Origin.** *Jl. of Exp. Med.* 53. 11-26. [With 4 plates, 3 tables.]

The authors describe a disorder in chicks which occurred during an experiment carried out to test the effects of a deficiency of vitamin E. Newly hatched chicks were at first put on a stock diet containing sufficient quantities of vitamins A, B, D and E, (vitamin C is not necessary for fowls). Two experimental diets containing vitamins A, B and D, but deficient in vitamin E and differing otherwise in their carbohydrate to protein ratio, were employed. The diets were composed of different proportions of milk powder, casein, starch, lard, codliver oil, salts, yeast and filter paper. Chicks were gradually changed over from the stock to the experimental food and control chicks were maintained on the stock diet. Many of the test chicks suddenly showed signs of great functional disorder at intervals of from nine to 38 days after the complete change over to the experimental diets. Most of the chicks showed symptoms between the 18th and 25th days and the ages of those



which became affected, varied between 19 to 48 days. The birds suddenly showed a loss of motor power and were usually found lying on their sides in a condition of prostration, but there was no true paralysis of the wings and legs. Death usually took place during the first few days of illness.

The characteristic lesion found at autopsy was a softening and degeneration of part of the cerebellum but in a few cases the cerebrum was the site of the lesion. After study of the histological changes the authors attributed the lesions in the brain to capillary embolism by a hyaline substance which was observed in the lumina of blood vessels.

Chicks which did not die quickly could be saved by the addition of green food to their rations, but they all showed some degree of inco-ordination after recovery from the acute illness and *post-mortem* examination of chronic cases showed a localised atrophy of part of the brain.

In order to ascertain whether the disease might be due to a specific infection, the authors made a number of sub-dural inoculations of brain suspension from affected to normal chicks, but the results were all negative. The fact that the lesions observed were of a purely degenerative character, supports the theory that the disease was not a specific infection. The authors consider that the disease may be due either to an intoxication originating in the intestinal tract or to a true nutritional deficiency owing to lack of vitamin E.

WEBSTER, Bruce, MARINE, David, and CIPRA, Anna. (1931.) **The Occurrence of Seasonal Variations in the Goiter of Rabbits produced by Feeding Cabbage.** *Jl. of Exp. Med.* 53. 81-91.

A series of experiments was carried out on a large number of rabbits kept under the usual laboratory conditions for upwards of two years, during which time they were fed on cabbages (250 g. each per day plus a weekly ration of 20 g. of hay and 50 g. of oats), the weights of their thyroid glands being determined at the end of the periods of observation. The rabbits were divided into two main classes, (a) those obtained before September, and (b) those obtained after April of the following year. It was found that the average weight of the thyroid glands of the first lot was about double the weight of those of the second lot. During winter, the weights of the thyroid glands increased steadily while winter cabbages were used. The cabbages were obtained continually throughout the experiment; those used in the winter were of the slow growing type, cut when mature and those used during the summer were of the spring variety, quick growing and cut while immature.

It was found that cabbages obtained from the same place differed considerably in their goitrogenic action from one season to another and that there was no difference between cabbages grown in America and those imported from Holland. The cabbages used were tested for their iodine absorbing power which was found to be in inverse ratio to their goitrogenic capacity.

STEYN, D. G. (1930.) **Pisgoed or Pisgras.** *16th Rpt. Dir. Vet. Ser. and Anim. Indust., Union of S. Africa.* pp. 417-420. Pretoria: Govt. Printer.

An opportunity was offered to investigate the condition known as "pisgoed" when an outbreak occurred among 400 merino wethers, of which 300 were affected and ten had died.

The condition occurs during hot wet weather and is characterised by swelling of the sheath with accumulation of urine within it. Within a few days vesicles appear on the swollen skin and mucous membrane and rapidly become converted into pustules. The pustules burst, leaving yellowish ulcers which become crusted over.

In experiments it was found that the condition could be produced by tying the wool round the prepuce so as to allow the products of decomposition of the urine to irritate the skin. It was also found that the disease was readily transmissible to healthy animals. Cure could be effected by removing the wool from the preputial orifice and applying antiseptics. No experiments have been carried out to test the value of the theory that the plant *Euphorbia genistoides* is responsible for the formation of urethral calculi which in turn cause urethritis. It is, however, mentioned that no calculi were found in the urogenital tract of three affected animals which were subjected to post-mortem examination.

The etiological factor has not as yet been identified.

BEKKER, J. G., and ROSSOUW, S. D. (1930.) **A Note on some Conditions in Sheep in the Strandveld of the Bredasdorp District.** *16th Rpt. Dir. Vet. Ser. & Anim. Indust., Union of S. Africa.* pp. 298-300. Pretoria: Govt. Printer.

It is characteristic of the sheep on Strandveld farms that they rapidly lose weight even though they are in good condition when brought on to them. The farms are used, however, because the wool produced there is of particularly fine quality. The majority of the farmers on the Strandveld farms of the district have inland farms where sheep thrive and there is thus a constant interchange of sheep going on.

Lamsiekte is the most important disease of sheep in the Strandveld area, but analysis of bones showed no marked differences as compared with controls. It was, however, clear that the bones possessed different physical properties. Those of Strandveld sheep are so brittle that they can be broken with the fingers. Osteophagia and allotriophagia definitely occur in sheep on the Strandveld.

Analysis of blood collected from sheep on a Strandveld farm showed that the average inorganic phosphorus content was 2.4 mg. P. per 100 c.c. of blood. This is less than half that of sheep on phosphorus-sufficient pastures.

The authors give analyses of the soil and vegetation from the Bredasdorp area, but it is not stated from what part of the area, nor are any figures of other districts given for comparison.

BRUCE, E. A. (1930.) **Nutritional Abortion of Sheep.** Canada. *Rpt. Veterinary Director-General, Dept. Agric. (Division of Animal Pathology.)* Appendix No. 21. Ottawa: F. A. Acland. (8vo.) [19 refs.]

An account of multiple abortions in a flock of sheep which occurred in the winter of 1922-23, and of investigations carried out. Five placentæ and 17 lambs were examined, nine of the latter having been born dead or having lived only a few hours. No outstanding or uniform lesions were found. Guinea-pig inoculations and cultures either yielded entirely negative results or lacked uniformity. The history of the flock was known and had been excellent, with the exception of the season immediately preceding that of the outbreak when goitre, general weakness and diarrhœa occurred in the lambs, but there were no premature births.

In the 1922-23 season the management of the sheep differed from previous years in that sunflower silage was used, the available hay was of poor quality and two grains of potassium iodide were given to the ewes twice weekly from the middle of October until January 1st.

The following is the author's summary:—

"From the end of September until December 5th, when winter feeding started, 72 pregnant ewes averaging about 175 lb. each were fed grain and had the run of pasture; when in the barn on wet days, and at night they had access to racks containing a poorly cured hay. Its composition was clover (50 per cent.), Italian rye (40 per cent.) and orchard grass (10 per cent.); on analysis it was shown to contain 1.69 per cent. of calcium. This hay was not eaten in any quantity, and if eaten at all, the grasses were preferred, and these carried only 13.9 per cent. of the total calcium in the sample. This hay was fed until January 4th. From December 5th to January 4th, all the ewes were on a ration of 1½ lb. corn silage, ¾ lb. sunflower silage, ¾ lb. cut orchard grass hay, and ¼ lb. grain mixture. Forty-nine of the ewes were bred to lamb in January and early February, the balance in March and April. In the winter lambing group of 49 ewes, 77.5 per cent. aborted. On January 4th, the hay was changed for a well-cured sample of similar composition, but carrying less clover, its calcium content being 1.28 per cent. Pulped mangels were substituted for ensilage for this group of ewes at the same time. Up to January 10th (six days after changing the feed) only 43.2 per cent. of the lambs born were raised, after that date 82.5 per cent. were raised.

"In the later lambing group, lot 1, consisting of eleven head, were changed on January 4th to corn silage and the new hay. Lot 2 were fed similarly until January 31st., when mangels were substituted for the silage. It was found that 55 per cent. of the ewes on the continued silage feeding gave birth to premature lambs, but raised 83.3 per cent. of them. The ewes on mangels had an abortion rate of 50 per cent., but raised 80 per cent. of their lambs.

"In the early lambing group the majority of premature births occurred from two to three days ahead, the longest was 15 days. In the later group one case occurred twelve days ahead of time, and it is of interest to note that the lamb lived.

"Clinically neither the ewes nor the lambs presented anything of interest, the only outstanding features of the outbreak being that the lambs were weak, underweight, and premature. As no evidence of infection could be found, and good results followed the change of hay, this outbreak is considered to have been due to a lack of suitable hay during pregnancy.



"The lack of leguminous roughage at such a time is especially significant. Whether the condition was an avitaminosis, a calcium deficiency, or both, or some other nutritional disturbance will be left to the judgment of those more versed in such matters than I. In so far as the farm affected is concerned, similar trouble was not known before, nor has it occurred since the outbreak but the feeding conditions existing at the time have not been duplicated."

### INVERTEBRATE VECTORS OF DISEASE.

PAPERT, J. L. (1930.) **Tsetse-Fly Survey of Zululand and Surrounding Territories.** 16th Rpt., Direct. Vet. Ser. & Anim. Indust., Union of S. Africa. pp.255-261. Pretoria: Govt. Printer.

The object of the survey was to determine the eastern limits of the fly, and the method adopted was to tether donkeys or cattle as bait and catch the flies settling.

The author gives descriptions of the various districts and areas in which the work was carried on (during 1928).

From the sketch map it appears that *G. pallidipes* was found at places on the north and south banks of the Pongola River in the Transvaal and Natal respectively, between the Umkuzi and Hluhluwe game reserves and the St. Lucia Lake, and also at a point some ten miles south of the Umfolozi game reserve. *G. brevipalpis* was caught at the eastern edge of the Hluhluwe game reserve.

Although baits were placed, no "fly" were caught at the following places:-north and south banks of the Maputa River in Swaziland, north bank of the Ingwavuma River in Swaziland, south bank of the Mkuzi River at the eastern margin of the Umkuzi game reserve on the western shores of St. Lucia Lake, in the Dukuduku Bush at the mouth of the Umfolozi River, and at Empangeni on the Umhlatusi River.

### PUBLIC HEALTH.

BEGG, H. (1931.) **Some Phases of Veterinary Inspection under the Milk and Dairies Acts and the Tuberculosis Order. Differential Diagnosis. The Application and Interpretation of the Double Intradermal Tuberculin Test.** Vet. Rec. 11. 1-8.

In the introductory part of the paper the author gives some practical hints on the way to carry out inspections, basing his advice upon his own experience. To prevent the contamination of milk he recommends that the tails of all female calves intended for milk production be docked. He describes the duties of a County Veterinary Inspector under the Tuberculosis Order of 1925, and discusses the double intradermal test.

### MINERAL AND PLANT POISONING.

METTAM, R. W. M. (1930.) **Poisonous Plants of Kenya.** Ann. Rpt., Dept. Agric., Kenya. pp. 377-417. [26 refs.] Nairobi: Govt. Press. [8vo.]

Plant poisoning occurs most frequently during the dry periods, but no definite period can be given as the rainy seasons vary in time and duration in different parts of the colony. While most cases of plant poisoning have occurred in cattle, sheep and pigs may also be victims. The diagnosis of plant poisoning, particularly when it is of a chronic character, presents great difficulty.

There is some suspicion that certain plants in a wilting condition may be poisonous on account of the presence of hydrocyanic acid in them, but actual proof is still wanting.

No botanical survey of Kenya has been carried out, but it is probable that the settled areas are less rich in poisonous plants than the coastal and the semi-arid regions.

It is impossible to give a useful abstract of the portions of this paper dealing with the plants individually, as in each case the author gives:—a description of the plant, synonyms, distribution, literature and present knowledge, parts of the plants proved to be poisonous, symptoms produced, post-mortem findings, pathological histology and diagnosis. The matter dealing with each plant covers several pages of the report.

The following poisonous plants are described under the above headings: *Gloriosa virescens*

(*Liliaceæ*), *Cassiadidymobotrya* (*Cæsalpiniaceæ*), *Ornithogalum longibracteatum*, *Dichrocephala chrysanthemifolia* (*Compositæ*), *Leonotis mollissima* (*Labiataæ*), *Acokanthera schimperiella et longiflora* (*Apocynaceæ*), *Asclepias platycalyx* (*Asclepiadeæ*).

A further paper is promised covering plants which require identification, and these will be submitted to Kew for that purpose. The plants described in the present report have been collected by the writer, and identification has been confirmed in every case by comparison with specimens in the *herbaria* either of the Government mycologist or the Forestry Department, or both.

MARSH, C. Dwight, and CLAWSON, A. B. (1930.) **Mountain Laurel (*Kalmia latifolia*) and Sheep Laurel (*Kalmia angustifolia*) as Stock-poisoning Plants.** *Technical Bull. No. 219. U.S. Dept. Agric. Washington, D.C.* [With 6 text figs, 21 refs.]

These two plants are among the most prominent stock-poisoning plants in the U.S.A. They produce the same effect, and their poisonous properties are due to the same substance, andromedotoxin.

Detailed descriptions of the plants and of the symptoms of poisoning are given. Experiments were carried out on cattle, sheep and goats, at the Salina Experiment Station, Utah, in 1927, 1928 and 1929, with material collected in the eastern part of the United States where the plants grow abundantly. Poisoning occurs chiefly in cattle and sheep, and goats are susceptible. There have been reports of the poisoning of horses.

The minimum toxic dose of *K. latifolia* (green plant) was 0.4 per cent. of the animal weight for cattle and goats, and 0.35 per cent. for sheep. The minimum toxic dose of *K. angustifolia* was 0.15 per cent. of the animal weight for sheep, and about 0.2 per cent. for cattle.

There is some evidence that the flesh of animals which have consumed the plant is toxic to human beings.

The administration of oil or grease is an effective remedy.

DESCAZEUX, J. (1930.) Intoxication des ruminants par *Cestrum palqui*. (**Poisoning of Ruminants by *Cestrum palqui*.**) *C.R. Soc. Biol.* **105.** 240-241.

*Cestrum palqui* is a solanaceous plant which grows abundantly in the prairies of central Chile near the Cordilleras. Poisoning is common in imported cattle; native cattle refrain from eating it, but are equally susceptible.

The author dosed some Chilean cattle *per os* and subcutaneously with extracts from various parts of the plant. The toxic doses were: 800 g. of the leaves and 40 g. of the fruit for adult sheep, and 3 kg. of leaves and 100-150 g. of the fruit for adult cattle.

Symptoms of poisoning appeared suddenly 8 to 15 hours after subcutaneous injection and 24 hours after ingestion: there was fever with muscular tremors, somnolence and paresis, and death occurred from respiratory syncope one or two hours after the onset of the symptoms. Lesions consisted of great congestion of all the organs, particularly of the lungs, kidneys, lymphatic glands and liver.

Owing to the rapid course of the illness, no effective treatment is possible. The plant is most dangerous when the fruit matures in the autumn.

QUIN, J. I. (1930.) **Further Investigations into the Problem of Geeldikkop (*Tribulosis*) in Small Stock.** *16th Rpt., Direct. Vet. Ser. & Anim. Indust. Union of S. Africa.* pp. 413-416. Pretoria: Govt. Printer.

It is not yet known why *Tribulus terrestris* can be grazed by sheep and goats without causing "geeldikkop," and yet at times the condition makes its appearance and causes immense losses. The plant cannot be accepted as poisonous in the ordinary sense of the term. A further point requiring solution is that animals are frequently lost from a disease presenting the symptoms of "geeldikkop" in areas where *Tribulus* does not occur. The author is of the opinion that "geeldikkop" should be considered as a symptom complex and not as a specific disease, and suggests that the same type of poisoning may be caused by a variety of different plants. In field experiments it was found that the



freshly expressed juice from 3 lb. of luxuriantly growing *Tribulus* in the fruiting stage proved fatal to young sheep in a few hours. An intense chocolate brown colour of the blood was the only recognisable lesion. The same type of *Tribulus* made into hay and fed to sheep produced no effect.

When an extract of hay was made, by soaking it after fine grinding, in cold water overnight, and then expressing the juice, it was found that extracts from 600 g. of hay proved fatal to young sheep within a few hours. When sublethal doses were given, brown discoloration of the mucous membranes and symptoms of asphyxia appeared, but these passed off rapidly.

Experiments with a quartz mercury vapour lamp failed to furnish any evidence that exposure to the Sun influenced the development of symptoms in the least. Intravenous injection of amyl nitrite, sodium nitrite and hydrogen peroxide, resulted in death from a cause apparently identical with that of the *Tribulus* extract. There was an intense brown discoloration of the blood. Spectroscopic examination revealed a band in the methæmoglobin position. *Tribulus* poisoning produces no hæmolysis.

I.—(1930.) **St. John's Wort—Possibilities of Control by Insects.** *Jl. Sci. & Indust. Res., Australia.* 3. 127.

II. CALVERT, J. (1930.) **St. John's Wort—Botanical Classification.** *Ibid.* 189.

III. TILLYARD, R. J. (1930.) **Entomological Control of St. John's Wort—First Liberations of *Chrysomela* Beetles.** *Ibid.* 231-232.

I. Some progress has been made with the investigations of the Division of Economic Entomology on the control of St. John's Wort (*Hypericum perforatum*) by insects. TILLYARD (1927) reported on the whole question of the possibilities of such control. Investigations have since been continued on the life histories of various groups of insects known to confine their feeding activities to the genus *Hypericum*. Studies of the insect genus *Chrysomela* have been carried out at the "Parasite Zoo" of the Imperial Bureau of Entomology, and shipments have been made to Australia of three species of *Chrysomela*. After preliminary study in Australia, a few specimens were liberated in October, 1929, on one plant in a closed compartment of the insectary at Canberra. These produced a brood of larvæ in December which entirely defoliated the original plant and spread to others. A larger brood developed from these in March, 1930, and the plants died as the result of the way in which the insects attacked them.

II. Deals with the identity of Australian species of St. John's Wort. While the young stages of the plant have been demonstrated to be toxic to sheep and cattle in Australia, there is no record of such effect in England. Specimens from New South Wales were sent to the Kew Herbarium for comparison with authentic material, and were found to be, not true *Hypericum perforatum* L., but a continental variety known as *H. perforatum* L. variety *Angustifolium* D.C.

The strains of the insect *Chrysomela* now being bred at Canberra were obtained on the Continent, so that the Australian variety of St. John's Wort is in all probability their native plant.

The author asks that dried specimens of the Australian plant, preferably when it is in blossom, and when some flowers have turned to seed, be sent to the Division of Plant Industry, C.S.I.R., Box 109, Canberra City, F.C.T., Australia.

III. Records experimental liberations at Tumbarumba, N.S.W., in an area of 5,000 acres in which the weed is very dense. Emphasis is laid on the fact that this work is purely of an experimental nature.

———. (1930.) **Experiments on the Control of Ragwort—Proposed Liberation of Cinnabar Moth (*Tyria jacobææ*).** *Jl. Sci. & Indust. Res., Australia.* 3. 67.

An exhaustive series of tests carried out in New Zealand has shown that, when the Cinnabar Moth is introduced, it causes great destruction to ragwort, and that it is harmless to economic plants. A short time ago about 500,000 specimens of the insect were liberated in ragwort infested areas in the Bay of Plenty, Kingstown country, Taranaki, Southland and the Nelson districts. Reports indicate that it has apparently become successfully established where liberated.

Pupæ were imported into Australia in 1929, and have been bred in an insectary. They have

been subjected to starvation tests on Australian flora, including species of *Acacia* and *Eucalyptus*. In each case the results were negative, the insects giving no indication whatever that they would attack the plant on which they were put. A permit for release has now been obtained, and it is probable that it will be made in an area in Tasmania at an early date.

The insect is common in England and parts of the Continent of Europe. It occurs wherever ragwort (*Senecio jacobaea*) is found, its larvæ feeding on this plant and also, less commonly, on groundsel (*Senecio vulgaris*).

SEDDON, H. R., and McGRATH, T. T. (1930.) **Toxicity of Sodium Chlorate.** *Austral. Vet. Jl.* **6.** 112-113.

In view of the fact that sodium chlorate has lately been recommended extensively as a weed poison, there was need to ascertain its toxicity for livestock. A test on a steer showed that sodium chlorate was quite palatable as, in 14 days, the animal took 266 g. when mixed with bone meal as a lick. It was then feeding badly and got gradually worse, until it was destroyed ten days after symptoms were first noted. The fatal dose for sheep was 50-75 g. Certain cattle have a particular liking for sodium chlorate in America. The chief danger lies in the possibility of cattle getting access to the product in bags. When sprinkled on land, animals would be unlikely to take a toxic dose, but it is advisable to keep them off recently treated land.

HINDMARSH, W. L. (1930.) **The Lethal Dose of Hydrocyanic Acid for Ruminants.** *Jl. Sci. & Indust. Res., Australia.* **3.** 12-13.

The author carried out experiments to ascertain the lethal dose for ruminants of HCN computed in terms of body weight, using a standardised sample filled into glass ampoules. It was injected intraperitoneally into five sheep, intrathoracically into one sheep, and given *per os* to three sheep. Toxic doses were: 1 mg. per pound body weight by intraperitoneal injection, 0.6 mg. per pound body weight by intrathoracic injection, and 1 mg. per pound body weight *per os*.

14 c.c. of Steele's solution injected intraperitoneally into a bovine animal weighing 560 lbs. caused grave symptoms lasting 155 minutes, but the animal recovered.

### SPECIFIC DRUG THERAPY.

WRIGHT, Willard H., and RAFFENSPERGER, H. B. (1930.) **Anthelmintics for the Removal of Thorn-Headed Worms from Swine.** *U.S. Dept. of Agric. Miscellaneous Publications.* No. 79. 11 pp. [9 refs.]

After a short summary of the results obtained by other investigators, the authors report the results of a series of disappointing trials of various anthelmintic drugs for the removal of *Macracanthorhynchus hirudinaceus* from swine. A dose of 25 c.c. of carbontetrachloride removed 12 out of a total of 101 thornheads from a group of 15 pigs. A dose of 32 c.c. of carbontetrachloride removed five out of a total of 52 thornheads in a group of twelve pigs. This same drug given in a dose of 45 c.c. to one pig removed the only two thornheads present. A dose of 30 c.c. of carbontetrachloride given along with 15 c.c. of a 1 per cent. solution of nicotine sulphate removed the only thornhead present. A 1.5 per cent. solution of 40 per cent. nicotine sulphate in a dose of 120 c.c. preceded by a purgative, removed four out of a possible 70 thornheads from two pigs. Tetrachlorethylene in doses of 10 c.c. and 20 c.c., given along with magnesium sulphate, removed one thornhead out of a possible 108 carried by a lot of six pigs. Ethereal extract of male fern in a dose of 4 c.c. proved to be quite ineffective when tried on a group of twelve pigs, none of the 19 thornheads being expelled. In a similar way, oil of chenopodium, kamala powder, kamala extract, iodine and liquor cresolis were found to be quite ineffective. The best results were obtained with carbontetrachloride, but as the effective dose was found to be dangerously near the toxic dose, its use is not advised. In spite of the unpromising results obtained, it is thought that nicotine sulphate and tetrachlorethylene are worthy of further trial. The response made by ascaris to the various drugs is also noted.



EGGERTH, Arnold H. (1931.) **The Germicidal Action of  $\alpha$ -mercapto and  $\alpha$ -disulfo Soaps.** *Jl. Exp. Med.* **53.** 27-36. [8 tables.]

This is an account of experiments made to test the selective action of various soaps on bacteria. These are sulphur containing soaps made according to methods described. The results are illustrated in tables which show that the germicidal efficiency of both series depends on the number of carbon atoms present in the molecule. It was found that this action improved directly with the number of carbon atoms up to a maximum, after which it fell quickly. In this case the optimum number of carbon atoms was found to be 12 to 14. The various soaps were tested with seven common pathogenic bacteria, and the selective action was well illustrated. The author's theory is that the germicidal action depends upon the power of the soap for penetrating into the bacterial cells and its bactericidal action on the protoplasm after penetration.

While the germicidal action increases with the number of carbon atoms, the penetrating power decreases and, after a certain ratio, the soap molecule becomes too large to enter the bacterial cell. The importance of the pH is referred to. There is very little difference between the respective actions of  $\alpha$ -mercapto and  $\alpha$ -disulfo soaps. Disulfo soaps are readily reducible to the mercapto forms. The author suggests that this new knowledge of the selective bactericidal action of soaps should be developed and applied to bacteriology, chiefly with the object of removing unwanted bacteria from contaminated cultures. This has already been done to a small extent in Avery's method of isolating *B. influenzae* by means of oleate-hæmoglobin agar.

LEGG, John. (1930.) **The Value of Bone Oil as an Adjuvant in Arsenical Dipping Fluids.** *Austral. Vet. Jl.* **6.** 93-98.

Bone oil is a complex chemical material obtained as one of the by-products in the manufacture of bone char, the latter being a substance largely used in certain processes associated with the manufacture of sugar from sugar cane. It is an evil-smelling, thick, viscid liquid, and can be emulsified with alkali.

The Queensland authorities have recommended the use of bone oil as an adjuvant in arsenical dips used for tick destruction, and one of the official dipping solutions set out in the Queensland Stock Act contains 1 gallon of bone oil per 400 gallons of sodium arsenite solution.

The author compared the effects of plain solutions of sodium arsenite of various strengths with similar solutions containing one gallon of bone oil per 400 gallons of solution. The cattle used in the tests had been exposed to natural tick infestation for at least a month before and were dipped in the usual manner, *i.e.*, they were immersed in the fluid and made to swim through it.

It was assumed that the engorged females obtained from the undipped control cattle were practically 100 per cent. viable. Two experiments were carried out; (1), in which a single treatment was given and in which six variants of the dip were used and (2), in which two treatments were given at intervals of five or ten days, using the same solutions as in (1).

EXPERIMENT I.—The following solutions were used:—(1) 4 lb. of arsenious acid per 400 gallons; (2) same as (1) plus bone oil; (3) 6 lb. of arsenic per 400 gallons; (4) same as (3) plus bone oil; (5) 8 lb. of arsenic per 100 gallons; (6) same as (5) plus bone oil. These strengths of arsenic are one-half, three-quarters, and the full standard strength of the recognised dips for use in Queensland.

Five animals were used in each group which contained, in addition, an undipped control. After treatment each group of animals was immediately stalled in a concrete floored stable, no bedding being allowed, and the animals were kept in the stalls for three weeks. All ticks were collected as they reached maturity as also were all engorged females which had fallen on the floor, these being all tested for viability. A few ticks were lost by falling into fæces or by being crushed by the animals' feet.

The efficiency of the arsenic solutions varied according to their arsenic content. All solutions killed the younger and less resistant stages. The addition of bone oil did not increase the effect of the stronger solutions with regard to tick destruction.

EXPERIMENT II.—The animals were allowed to run in infested pasture between dippings but, after the second dipping, searches were made for fertile ticks, and the animals were allowed to graze in a "clean" paddock. When ticks had survived treatment with the 6 lb. and 8 lb. dips, there was reason to believe they may have escaped full contact with the liquid, or else survived the first treatment

and reached a resistant stage at the time of the second treatment. The bone oil did not appear to increase the efficiency of the stronger solutions. Tables are given showing details of the actual results obtained.

**Report of Committee of the Am. Vet. Med. Ass. on Veterinary Biological Products.** (1930.) *Jl. Amer. Vet. Med. Ass.* 77. 499.

The Committee has begun to classify the following Veterinary Biological products:—canine distemper vaccine, pulmonary œdema bacterin, abortion bacterin and abortion vaccine.

These were all placed in Group B of the Committee's Regulations (products whose use or manufacture is in the experimental stage).

ROBBINS, Benjamin H. (1930.) **A Proteolytic Enzyme in Ficin, the Anthelmintic Principle of Leche de Higueron.** *Jl. Biol. Chem.* 87. 251-257. [7 refs.]

In preliminary investigations it was found that *Ascaris lumbricoides* placed in Ringer's solution at 36° C., containing 1 to 2 per cent. of "leche de higueron" (the crude sap of *Ficus laurifolia*) soon became wrinkled and flaccid, and in the course of one or two hours developed ulcers which later perforated and caused death. The technique used in this first experiment was later adapted to test the anthelmintic activity of various fractions of the sap, and the active principle was found to be contained in an amorphous substance which can be separated out by protein precipitants. By a process of reprecipitation and drying an anthelmintically active yellow powder named "ficin" was obtained from this substance, 100 c.c. of the sap yielding 11 to 12 gm. When tested on *Ascaris*, in strengths of 0.1 and 0.2 per cent. in Ringer's solution, ficin produced perforation of the body wall in two hours. It was found to give positive reactions to protein tests, and that exposure to 75° C. for five minutes destroyed its activity. This suggested its enzyme nature, which was afterwards investigated by digestion experiments and by the determination of its optimum pH. An observation that the activity of the enzyme is destroyed in an acid medium of pH 2 to 3 is of peculiar interest and offers an explanation for the relatively enormous anthelmintic dose of the crude drug, a large proportion of which may be destroyed in passing through the stomach. The enzyme appears to be allied to trypsin, but must have some peculiar property of its own as trypsin has no action on *Ascaris*. The author thinks it possible that more than one enzyme may be present, but the experiments which he carried out to investigate this point are not conclusive and further work is being done.

### MISCELLANEOUS.

CANHAM, A. S. (1930.) **Blood of Cattle.** 16th Rpt. Direct. Vet. Ser. & Anim. Indust. Union of S. Africa. pp. 531-553. Pretoria: Govt. Printer.

This paper, which describes the author's work in connection with the normal blood of healthy South African cattle, is a corollary to NESER's work on the blood of equines (1923).

The technique employed was that described by NESER, with one or two minor modifications. Observations were made to cover the influence of the following factors upon the blood:—age, exercise, pregnancy and parturition, oestrus, altitude and lactation. The leucocytes were examined as to the types present, number, differential counts, and general observations regarding them.

The paper contains an immense amount of detailed information in the form of tables. It was found that exercise tended to increase the number of red corpuscles, while lack of exercise caused a fall.

In animals up to one year of age, the red corpuscle count is higher than in animals over that age. In calves up to one year old, the figure is about nine million per c.mm. but, in animals between one and three years, it is about seven and a half million per c.mm. In adult animals there is a further drop to about six and a half million per c.mm.

Veld animals, in spite of the amount of exercise taken, usually show a lower count than high-class dairy cows, but their white cell count is higher. Working oxen show the highest counts.



The author has not been able to arrive at any definite conclusions regarding the influence of pregnancy as a sufficient number of animals has not been examined. The indications are, however, that, with the onset of pregnancy, there is a rise followed by a slight fall and another rise at the time of parturition.

Only a few counts have been made of animals in œstrum, and in these there seemed to be a general tendency for a slight rise to occur. A few counts have been made of animals living at about 3,500 ft. and 4,500 ft. above sea level, and the figures appeared to be definitely higher for the animals at the greater altitude. The author hesitates to express the view that the differences were entirely due to altitude.

Actually no figures were obtained to indicate the influence of lactation on the blood count, because the author points out that to obtain these it would be necessary to keep the cows empty for a year. A few counts were obtained from pregnant cows at different periods of lactation.

Enumerations of leucocytes showed that in young animals the count is higher than in adults, and that it is higher in females than in males. In the first year of life the count approximates to 11,000 per c.mm. and with increasing age, it falls to about 5,000 to 6,000 per c.mm. *Veld*-reared cows showed an average of 11,000 per c.mm.

No very clear differences were to be detected in the differential counts of leucocytes from animals of different ages, although there were some individual variations. Averages were: lymphocytes, from 48 to 68 per cent.; monocytes from 3 to 6 per cent.; neutrophils from 29 to 34 per cent.; eosinophiles from 8 to 17 per cent.; basophiles, 1 per cent.

Pregnancy and parturition appear to produce some fluctuations, but the average remains fairly constant.

Contrary to what appears to be the case with horses (NESER), exercise does not increase the white cell count in cattle.

Œstrum would seem to cause not only an increase in the number of red cells, but also a relative increase in the number of neutrophils and the counts, from the small number of observations made, would appear to be higher before milking than after.

Rossouw, S. D. (1930.) **A Short Study of the Isotonicity of Sheep Blood.** *16th Rpt., Direct. Vet. Ser. & Anim. Indust., Union of S. Africa.* pp. 525-529. Pretoria: Govt. Printer.

The writer points out that there is a difference between an isotonic salt solution and an isosmotic salt solution. Solutions below a certain percentage strength of sodium chloride produce complete hæmolysis. As the percentage strength is increased, the percentage of hæmolysis falls until it ceases to occur. Further increases in salt concentration cause shrinkage and crenation of the corpuscles. An isosmotic solution is one which produces no changes in the corpuscles.

Hæmolysis curves were obtained in the following way. A number of solutions of sodium chloride differing by 0.01 per cent. are made from stock 0.85 per cent. solution covering the range 0.6 to 0.74 per cent. 20 c.c. amounts are placed in centrifuge tubes, and one tube contains distilled water. Sheep are bled from the jugular and, before the blood can coagulate, 1 c.c. is pipetted into each tube, and well mixed. The tubes are allowed to stand for 15 minutes, and are then centrifuged at 3,000 r.p.m. for ten minutes. The tubes containing distilled water and blood represent complete hæmolysis, and from this, standards are made by dilution for comparison with the suspensions of corpuscles in the salt solutions. In this way it was possible to determine hæmolysis down to 2 per cent.

A graph can be constructed and, by making two dilutions of blood in salt solutions of known percentage of strength, the degree of hæmolysis can be expressed as a percentage.

Three per cent. hæmolysis was found to be the lowest practicable margin to work at, and the average percentage of sodium chloride solution of 14 estimations of sheep blood was found to be 0.76

0.9 per cent. sodium chloride is found to be the most practical isotonic solution for the blood of sheep.

## REPORTS.

— (1930.) **Report of A.V.M.A. Representative on the National Research Council.** *Jl. Amer. Vet. Med. Ass.* 77. 480.

The Report deals with the state of research into bovine infectious abortion in the U.S.A. The Research Committee consists of Drs. MOHLER, GILTNER, HARDY and HUDDLESON. With the aid of grants from various sources, the work to be done is divided into five parts :—(1) immunological studies; (2) brucella culture collection—study of new cultures, and methods of identification, &c.; (3) brucella infections in swine; (4) the chemistry of brucella—study of metabolism, and chemical composition of different species; and, (5) diagnostic studies—determination of susceptibility, immunity, and infection by intracutaneous tests, and physico-chemico reactions.

CANADA. (1930.) **Report of the Veterinary Director-General for the Year ending March 31st, 1930.** [HILTON, George.] Dept. Agric. 59 pp. Ottawa: F. A. Acland. [8vo.]

The Veterinary Director-General gives an account of the whole of the work carried out and the detailed reports of the Contagious Diseases Division [CAMERON, A. E.], of the Pathological Division [WATSON, E. A.], and of the Meat and Canned Foods Division [BARNES, Robert], are given separately. These are dealt with elsewhere in this journal, as also are papers on nutritional abortion in sheep and on turkey rearing in confinement for the control of "blackhead" which are included within the report of the Pathological Division.

There were no extensive outbreaks of disease during the year. Constant vigilance is maintained to prevent the introduction of foot-and-mouth disease and, to emphasise the need for this, the Veterinary Director-General points out that, in spite of the strictest precautions and a well-organised and competent veterinary service, the disease has been introduced into the United States on nine separate occasions. He pays a well-deserved compliment to the United States veterinary services for the efficient manner in which they eradicated the outbreaks that did occur, and says that, in the history of veterinary sanitation, no outbreak of such a highly infectious disease was ever so speedily and effectively dealt with as the one which broke out in California in January, 1929 as the result of pigs being fed on garbage from a merchant vessel which called at a port in that State.

During the period under report, the importation of live stock susceptible to foot-and-mouth disease was possible from Scotland except for the period September 9th to March 9th. Great satisfaction is expressed at the prospect of less restricted importations from England now that the incidence of outbreaks has been so markedly diminished.

It was not, however, considered prudent to relax in any way the embargoes and restrictions upon various commodities from countries in which the disease is known to exist, or from countries which, owing to their proximity to infected territory, must be regarded with suspicion.

There have been no cases of dourine for ten years, but a regular watch is kept for it, and the serum of all suspected animals is submitted to the complement-fixation test. There have been no cases of sheep scab for two years. Anthrax has never been a serious menace in Canada; during the year, its incidence was limited to the Province of Ontario, and not more than three animals succumbed to it. There were very few outbreaks of glanders, and the hog cholera situation was satisfactory, as only twelve outbreaks required attention, two in Quebec and ten in Ontario. The incidence of mange in horses was limited to nine animals in New Brunswick. Outbreaks of rabies continued to occur in the Provinces of Quebec and Ontario, but there were less cases than in the previous year. The value of prosecuting those who disobey quarantine regulations, imposed to help in the control of the disease, is emphasised.

An optional plan was adopted in January, 1929 for the assistance of cattle owners desirous of controlling bovine contagious abortion. The response was not great, and only 26 herds were being dealt with. The disease is a menace to cattle breeding interests, and the department considers that there is need for further extensive investigations.

The regular duties of the Branch include a permanent progressive campaign to control bovine tuberculosis, and there is a strong public demand for this phase of the work. Numerous applications were received for the acceptance of herds under the "single herd policies" of the department, and petitions were received with the required number of signatures of cattle owners in specified territories for the declaration of new areas.



There is actual difficulty in satisfying the demand for the work involved in these schemes which now include the supervision of a million cattle. There is a shortage of suitable men for recruitment to the service and, for this reason, material increase in the staff has been impossible. Only a score of new graduates were available throughout the Dominion during the year, and there is little prospect of an increase in this number.

In view of the nation-wide scale of the tuberculosis work in the U.S.A., where federal, state, county and municipal authorities have been working together for the past twelve years, with the result that the incidence of the disease has been appreciably lessened, the U.S.A. is naturally taking measures to protect its clean areas from infection from outside sources. There is, in consequence, the most urgent need for Canada to make equally rapid progress in the control of tuberculosis, and the Veterinary Director-General very strongly emphasises that the time is now ripe for mustering all forces in a united co-operative campaign. He therefore advocates action by the provincial authorities so that they may co-operate with the federal services.

The work of the Meat and Canned Foods Division is described, and there is an interesting discussion of the problems dealt with by the Pathological Division, including a review of certain of the earlier Canadian investigations.

**CANADA. (1930.) Report of the Contagious Diseases Division—Health of Animals Branch, Department of Agriculture for the year ending March 31st, 1930. [CAMERON, A. E.] pp. 14-33. Ottawa: F. A. Acland.**

This is a report to the Veterinary Director-General. A considerable number of veterinary inspectors from this Division have been employed from time to time in conducting the inspections of cattle and premises, rendered necessary by the United States Import Milk Act, to permit of exportation of milk and cream to the United States.

No serious outbreaks of contagious disease occurred during the year. The veterinary staff were, in consequence, able to devote a considerable amount of time to testing cattle for tuberculosis.

**ANTHRAX.**—Three cases occurred in Ontario, and one outbreak occurred in Quebec. Anthrax has never been a serious menace in Canada.

**DOURINE.**—No cases have occurred during the last ten years. The serum of suspected animals is submitted to the complement-fixation test.

**GLANDERS.**—Eight horses were slaughtered in three outbreaks in Quebec, and 18 were slaughtered in one outbreak in Saskatchewan. With careful tracing and mallein testing of contacts, slaughter of reactors and payment of compensation, the disease is effectively controlled.

**SWINE FEVER.**—Sixty-eight hogs were destroyed in two outbreaks in Quebec, two hogs in one outbreak in British Columbia, and 568 hogs in nine outbreaks in Ontario, the latter being the aftermath of a serious outbreak during the previous year.

**MANGE IN CATTLE** occurred in New Brunswick, Ontario, Manitoba, Saskatchewan and Alberta. The disease was dealt with by quarantine and suitable treatment. Most of the outbreaks involved quite small numbers of animals, but nearly 6,000 cattle were quarantined and dipped under supervision in Alberta.

**MANGE IN HORSES** was limited to two outbreaks, one in New Brunswick, and one in Manitoba.

**SHEEP SCAB** has not been reported during the past two years. Careful inspections are made of the flocks in the districts in which the disease formerly existed.

**RABIES** occurred only in the Provinces of Ontario and Quebec, but in these Provinces it has continued to occur in widely separated districts. Contacts have been traced and quarantined, and municipalities have been invited to co-operate by passing and enforcing bye-laws restricting the movement of dogs. As no extensive outbreaks have occurred, this procedure has been satisfactory. The disease occurred in 61 dogs, 20 cattle, 9 sheep, 3 hogs and 3 cats.

#### **TUBERCULOSIS.**

**Accredited Herd Plan.**—Under this plan the owner is required to have ten head of pure-bred cattle of one breed, registered in his own name, before his application is accepted. Six of these must be over six months of age, including a herd sire of at least one year. The pure-bred animals must also constitute at least one-third of the entire herd. Before an accredited herd certificate is issued, the owner must be in possession of 15 pure-bred registered cattle. An accredited herd is

one which has passed two "clean" tuberculin tests with an interval of one year or, in case reactors are found, three "clean" tests with intervals of six months.

Four thousand six hundred and fifty-three herds were fully accredited, 1,295 herds were undergoing accreditation, and 149 herds were awaiting test. When accredited herds are included in restricted areas, many owners have preferred to come under the area plan in preference to continuing as individual herds.

*Supervised Herd Plan.*—Owners of grade herds, or those who cannot qualify for the Accredited Herd Plan, can establish "clean" herds under the Supervised Herd plan; practically the same methods are followed under both plans, but no compensation is paid for reactors under the latter scheme. 1,530 herds have been tested under the arrangement. Supervised herds in a district which is established as a restricted area are automatically included in the area test, and are no longer dealt with as individual herds.

*Municipal Tuberculosis Order.*—Under this order, herds supplying milk to municipalities which have applied to the Federal Department of Agriculture for assistance, are tested with tuberculin and compensation is paid for reacting animals, but no additional municipalities have been accepted under this order for over six years. One municipality in Saskatchewan has been dropped, and one in Manitoba has been included in a restricted area, so that only 27 municipalities now receive service. These are in Ontario (seven), Manitoba (nine), Saskatchewan (eight) and Alberta (three).

*Restricted Areas for the Eradication of Bovine Tuberculosis.*—A large number of cattle have been tested in new areas and these, together with the retests necessary to maintain the areas, have involved the testing of over half a million cattle during the past year.

An account is given of each gazetted Restricted Area in each province, of the number of herds included, of the number of reactors, and of the amount of compensation paid.

*BOVINE CONTAGIOUS ABORTION.*—A scheme for the control of the disease has been inaugurated. The response from farmers has not been great, but 26 owners have signed agreements with the department, and the appropriate measures have been put in force. The owner is required to employ his own veterinarian to take blood samples, and these are forwarded to the department's laboratories to be tested. The officers of the department advise as to the details to be followed to control the disease by the slaughter of infected animals or by isolation and sanitary measures. Reactors, if not slaughtered, may only be retained by the owner or disposed of to other stockowners who are fully aware of the fact that they are reactors.

*INSPECTION OF STOCK CARS AND YARDS.*—Stock cars are cleansed and disinfected at 31 railway centres in the Dominion. Stock car inspectors are maintained at these points and all stock cars arriving at or passing through these points are cleansed and disinfected under supervision, unless they show evidence of having been so treated. Cards are affixed to these cars showing the date of release and the name of the inspector who supervised the disinfection. Railway companies co-operate fully in this work.

All stock yards in the Dominion are cleansed and disinfected also to ensure comfort and sanitation.

During the year 88,537 cars were cleansed and disinfected under supervision.

TABLES showing various statistics are appended to the report. Animals were slaughtered and compensation was paid in connection with certain diseases, as follows:—glanders, \$1,791 for 26 animals; swine fever, \$5,478 for 640 animals; and tuberculosis, \$691,369 for 17,912 animals. Comparisons are given for each year since 1904-05.

Ninety-six animals became affected with rabies in 27 outbreaks, and quarantine was imposed on 2,908 animals.

Under the Area Testing Scheme, 303,136 first tuberculin tests were made on 542,976 animals. There were 14,538 reactors (2.7 per cent.); 14,486 animals valued at \$759,604 were slaughtered, and \$506,403 were paid as compensation. Details are given for each area. Under the Accredited Herd Plan, 51,980 first tuberculin tests and a total number of 215,430 tests were made on 186,745 cattle. There were 2,190 reactors (1.2 per cent.); 2,160 reactors and five suspected animals valued at \$206.33 were slaughtered, and \$137,555 were paid as compensation. Under the Municipal Testing Plan, 26,984 first tuberculin tests and a total of 93,616 tests were made on 76,998 animals. There were 1,335 reactors (1.7 per cent.); 1,261 reactors valued at \$71,141 were slaughtered, and \$47,410 were paid as compensation.

8,761 horses, 137 mules, 1,360 cattle, 15,129 sheep, 51 swine and 48 goats were inspected on importation from the United States and Newfoundland.



231 horses, 1 mule, 546 cattle, 344 sheep and 18 swine were inspected on importation from Great Britain, Ireland and Europe.

851 horses, 396,736 cattle, 6,479 sheep and 464,855 pigs were inspected prior to export.

Ministerial Orders relating to live stock, passed during the year, are appended in the report.

CANADA. (1930.) **Report of the Pathological Division, Health of Animals Branch, Department of Agriculture, for the year ending March 31st, 1930.** [WATSON, E. A.] pp. 34-53. Ottawa : F. A. Acland. [8vo.]

This is a report to the Veterinary Director-General, and it includes papers on nutritional abortion of sheep and on turkey rearing in confinement for the control of blackhead. These are dealt with separately elsewhere in this journal.

The work of the division increases considerably each year, and there is insufficient staff to cope with the problems which require investigation.

A considerable amount of routine diagnosis and manufacture of biological agents is done. 2,287,190 doses of tuberculin for the intradermal, ophthalmic and subcutaneous tests, and 7,458 doses of mallein for the intradermal and subcutaneous tests were prepared. 14,734 specimens were received for diagnosis and classification.

RABIES.—164 carcasses or heads of suspected animals were dealt with. Negri bodies were demonstrated, or the disease was produced in rabbits, in 73 instances.

DOURINE.—Although the disease was eradicated from Canada several years ago, a certain amount of routine examination of blood samples by the complement-fixation test, is carried out according to the technique Watson described. As the result of his work on the subject, blood samples are sometimes sent from other parts of the Empire for testing, and during the year the department was able to help an Eastern country in this respect.

NECROTIC ENTERITIS OF SWINE.—An outbreak proved on investigation to be *S. suispestifer* infection in the absence of the virus of swine fever.

DISEASES OF SMALL LABORATORY ANIMALS.—An outbreak of disease which occurred in rabbits in the laboratory proved to be an infection with *S. enteritidis*. An account of work done on this question will be published.

*Br. Abortus* INFECTION IN CATTLE.—Several years ago the Division undertook to establish a plan for the control of *Br. abortus* infection by segregating infected animals and preventing the infection of the calves of these animals. Two herds were taken under the control of the Division, and the staff is favourably impressed by the results obtained. It was soon convinced, however, that the agglutination test in itself does not meet all the requirements of a specific diagnostic test, since non-infected animals occasionally failed to react; the same results were obtained with the complement-fixation test, but the use of both tests reduced the number of errors to a minimum. After the Division was satisfied that a reliable means of diagnosis was available, arrangements were made with the Experimental Farms Branch, Department of Agriculture, to co-operate in a trial in which :—

(1) Herds are subjected to both tests and reactors are removed. When only a few reactors are found, they are disposed of preferably by slaughter; when they are numerous the herd is divided into two units, a reacting unit and a non-reacting or "clean" unit, each being housed and maintained separately. (2) Non-reacting herds are tested quarterly until they have passed at least three "clean" tests; thereafter they are tested annually. (3) All additions are tested before they enter the herd. (4) Calves from reacting cows are removed at birth and kept in a neutral zone for ninety days. They are fed on pasteurized milk or milk from non-reacting animals, and are tested before they are introduced into the "clean" herd. (5) Where possible, all milk from reacting herds is pasteurized. A table shows the results obtained on 24 farms.

Emphasis is laid on the importance of udder infection with *Br. abortus*.

#### TUBERCULOSIS.

BCG Vaccine.—The results obtained in the trials have usually been progressively less satisfactory as the period of observation has been increased.

WATSON has carried out extensive researches on this question since 1924, and he has been unable to report favourably on the vaccine for various reasons. While its use appears to delay or retard

progressive disease for a relatively short period in the early life of the vaccinated animal, it appears to be incapable of conferring an efficient degree of immunity. Vaccinated cattle exposed to infection are frequently carriers and eliminators of virulent tubercle bacilli, and thus help to spread infection.

Watson questions the claim that the vaccine is itself harmless. He admits that is attenuated, but considers that, after a long sojourn in the body of an animal, its virulence may be restored. The use of the vaccine in Canada would be unjustifiable.

*The Biology and Pathogenicity of the Tubercle Bacillus.*—Attention is drawn to the large number of strains which, after isolation from mammals and birds, do not conform to the arbitrary standards set for the human, bovine or avian type of the tubercle bacillus. There is increasing evidence that all strains, regardless of their source and present characteristics, are capable of undergoing a considerable amount of modification after passage through different hosts.

Investigations have been carried out on the biochemistry of tuberculin; on the allergic reactions in tuberculous animals to the protein and carbohydrate fractions of tuberculin, and to extracts and purified products of the tubercle bacillus; and also on dissociation of the tubercle bacillus into virulent and non-virulent forms.

**EQUINE PERNICIOUS ANÆMIA (SWAMP FEVER).**—This disease causes considerable loss every year in the provinces of Manitoba, Saskatchewan and Alberta, and the Division has studied it for many years, principally at the Research Station, Lethbridge, Alberta. The work is now chiefly directed towards finding better methods of diagnosis, especially by means of an efficient laboratory test; to determining the nature of the virus and the natural modes of transmission; and to the elaboration of prophylactic treatment by inoculation with an attenuated virus.

**CHRONIC BOVINE HÆMATURIA** occurs in certain localities in the province of British Columbia, especially in the coastal region. Earlier work has shown that it is not an infective disease, and that nutritional disturbance, mineral deficiency, hyperacidity, or an unknown factor in the soil and vegetation, is probably responsible for its occurrence. A co-operative survey has been commenced between the Pathological Division and the Chemical Division of the Experimental Farms Branch of the Department of Agriculture.

**BRANCH LABORATORIES.**—The work of the branch laboratories at Agassiz, British Columbia (BRUCE, E. A., Pathologist in Charge), at Lethbridge, Alberta (HEATH, L. M., Pathologist in Charge), and at the Poultry Diseases Laboratory at the Central Experimental Farm, Ottawa (WEAVER, C. H., Pathologist in Charge), is included in the report of the Pathological Division.

A preliminary list of parasites of animals in British Columbia is given. Two attempts were made in Alberta, one in April 1929, and one in March 1930, to observe cases of the seasonal condition known as "jiggers" and alleged to be prevalent among range horses in certain districts, but no cases were found on these visits. The condition is said to be very serious to the horse-raising industry and is believed by some people to be due to a deficiency in the food supply, but the information gathered did not support these suggestions.

**CANADA. (1930.) Report of the Meat and Canned Foods Division, Health of Animals Branch, Department of Agriculture, for the year ending March 31st, 1930. [BARNES, Robert.] pp. 53-59. Ottawa: F. A. Acland. [8vo.]**

This is a report to the Veterinary Director-General, and deals with the slaughter and the inspection of animals and animal products for food. In comparison with the previous year there was a slight increase in the number of cattle and a considerable increase in the number of sheep dealt with, but there was a big reduction in the number of pigs brought in. Improvements in the production of bacon hogs have strengthened the position of Canadian products on British markets, and the price obtained has compared favourably with that paid for Danish products, Denmark being the keenest competitor in these markets. Canada should therefore be able to increase the production of bacon hogs.

The Division inspects the work carried out in 60 establishments which operate under regulations governed by the Meat and Canned Foods Act of Canada. Some establishments may commence to slaughter horses for export to the countries in which there is a demand for horse flesh. Separate "plants" will be required as horses cannot be slaughtered in the same places as cattle, sheep or hogs, but those concerned are prepared to build and equip them.



There has been a considerable increase in the production of manufactured poultry products. 1,112,513 cattle, 765,824 sheep, 2,226,265 pigs, 20 goats and 210,547 poultry were inspected. Details and statistics are given of the causes for which carcasses were condemned. 1·49 per cent. of the cattle, 0·23 per cent. of the sheep, and 0·28 per cent. of the swine were condemned.

NEW SOUTH WALES. (1930.) **Live Stock Diseases Report Recording Work During the Year ended June 30th, 1929.** Dept. of Agric. [HENRY, Max.] [Printed Report, 8vo.]. Sydney.

STAFF.—There has been, and is, considerable difficulty in securing the services of a sufficient number of veterinarians for appointment, but it is anticipated that in a year or two a larger number of men will be forthcoming from the veterinary school of Sydney University. At present the Veterinary staff consists of the Chief Veterinary Surgeon, the Director of Veterinary Research, (whose report will be dealt with separately), and the staff at the Glenfield Laboratory, the Chairman, Board of Tick Control, one Senior Veterinary Surgeon, one Senior Veterinary Research Officer, and three District, and four other Veterinary Officers. Emphasis is laid on the need for more District Veterinary Officers.

OVERSEAS QUARANTINE.—This work is carried out by the state staff under the immediate supervision of the Director of Veterinary Hygiene of the Commonwealth Department of Health, the Chief Veterinary Surgeon holding the position of Chief Quarantine Officer (animals), New South Wales. The establishment of the Quarantine Station in London, for stock about to be sent overseas, has enabled the trade in stud stock between Great Britain and Australia to assume more normal proportions. Twelve cattle, 81 horses, 1,145 sheep, 3 pigs and 111 fowls were brought in through the port of Sydney, from countries outside Australia. There is a quarantine station at Abbotsford, in New South Wales.

BORDER CONTROL.—Inter-State traffic with Queensland and South Australia is controlled. 6,085 horses, 96,765 cattle and 9,114 sheep were dipped or sprayed with arsenical solution as a precaution against the introduction of cattle ticks. As a result of the satisfactory work against swine fever in Victoria, prohibition against pigs from that state was modified so as to allow them to enter under certain restrictions. At the end of the year, arrangements were in train to allow pigs from South Australia to come in under the same restrictions.

CONTAGIOUS BOVINE PLEURO-PNEUMONIA.—There was an increase of 33 outbreaks over the number which occurred in the previous year, due to the situation in County Cumberland. This county presents a problem which is entirely its own. Satisfactory control has not yet been achieved, and without the appointment of additional officers, one of whom would have to devote the whole of his attention to the campaign against the disease in this area, it is not likely to be brought about. A graph is given which shows the incidence of the disease in the state for the past eleven years, and also the importations of cattle into New South Wales from Queensland and Victoria.

SWINE FEVER.—The disease was present in the state at the beginning of the year, but during the latter half of 1928 there was only one outbreak, and that was 280 miles distant from the nearest one elsewhere. Emphasis is laid on the importance of garbage in the spread of the disease.

ANTHRAX.—There were 24 outbreaks, involving 75,239 sheep and 295 cattle, and resulting in the death of 1,103 sheep and six cattle. Protective inoculation was carried out on 4,711 cattle and 142,501 sheep. Two outbreaks occurred in travelling sheep on the travelling stock route, and it was necessary to quarantine the route. In the West District, with one exception, the disease was seasonal, outbreaks occurring during the summer months, and coinciding with the seeding of the grasses.

PIROPLASMOSIS.—No outbreaks occurred during the year.

BLACK QUARTER.—90 outbreaks occurred.

TUBERCULOSIS.—1,174 cattle were destroyed as being affected with tuberculosis, the majority being detected on farms and in sale yards, &c. Work was continued on accredited tubercle-free herds. 2,055 animals were tested under the scheme, and 46 (2·23 per cent.) reacted. Herds submitted to a first test showed 5·63 per cent. reactors. The intradermal test is said to be more applicable to work in closely settled countries than in New South Wales, where cattle are often tested at very long distances from the veterinary officer's headquarters.

CANCER.—137 animals were destroyed on account of cancer, either cancer of the *membrana-nictitans*, or what is known as "brand cancer."

ACTINOMYCOSIS.—536 cattle were destroyed on account of affection with this disease.

LICE AND KEDS IN SHEEP.—In the south the situation with regard to these parasites does not appear to be unfavourable. Most cases of infestation are discovered at saleyard inspections. In the north the situation is difficult in New England, and also in Manoro in the south-east, as the presence of keds in these areas appears to offer greater obstacles to control than does the louse in the west of the state. The District Veterinary Officer (West) reports that owners are apparently alive to their responsibility under the Stock Diseases Act, 1923. Regular inspections were carried out at country saleyards, and prosecutions were made when necessary. Lice were considerably more prevalent than keds. The adverse experience in the west during the previous summer, and the continuance of the dry conditions into the autumn, as a result of which many owners were unable to dip on account of water shortage, were responsible for an increase in the number of holdings placed under quarantine during the year on account of the presence of these parasites.

BLACK DISEASE IN SHEEP.—Now that the research officers have made such progress with regard to the etiology of the disease, field officers will be able to undertake control measures, particularly in the direction of the control of liver flukes. The presence of the disease has been observed for the first time on the northern table lands of New South Wales.

LIVER FLUKES. Losses from the use of carbontetrachloride have occurred, but only in odd instances. In one herd, after dosage with the drug, 550 ewes died out of 2,000, and 200 others lost their wool. In one instance in which cattle were drenched with 20 c.c. of carbon tetrachloride in 80 c.c. of liquid paraffin, severe systemic disturbance, with cessation of milk supply occurred, but all the animals recovered within a week. Losses from infestation with this parasite were very light in the south, but this was probably related to the occurrence of dry seasons since the last bad year in 1926.

STOMACH WORMS.—Worm infestation throughout the north and north-west slopes of the state was experienced during the greater part of the year. During the dry period experienced around Boggbari, Narrabri, Gunnedah and Moree, infestation was heavier than had hitherto been noted, and was reported on some holdings for the first time. In addition to the usual trouble in the autumn and winter, these parasites were much in evidence during the summer in the drought-stricken areas. Conditions were very dry and sheep were under-fed, and on investigation were found to be heavily infested with *Haemonchus contortus* and *trichostrongyles*. Excellent results were reported after drenching on two occasions with copper sulphate and mustard with an interval of 14 days.

DIETETIC DISEASES.—The District Veterinary Officer (South) reports that the diseases of this nature can be divided into (1) pre-parturient toxæmia of ewes, (2) plethoric toxæmia of lambs, (3) toxæmia of sheep associated with good crop or natural feed, and (4) other types of nutritional disorders; interesting details are given concerning these ailments.

OTHER DISEASES.—There is brief mention of the fact that material from the following conditions was forwarded to the research staff at Glenfield; this is worth enumerating for the sake of those who are interested in the distribution of the common diseases and, incidentally, to illustrate the number of well-known conditions in the United Kingdom which occur overseas:—sheep blow-fly, lungworm in sheep, nasal bot, pneumonia in sheep, botulism, toxæmic jaundice, "swelled head" in rams, infectious labial dermatitis in sheep, septic metritis in ewes, balanitis, mycotic dermatitis, foot-rot, orchitis in rams, sterility in rams, ophthalmia, tetanus, osteoporosis, joint-ill, contagious abortion, contagious mastitis, polyarthritis of sheep, caseous lymphadenitis, bacterial hepatitis in sheep, contagious pneumonia in pigs, sterility in cattle, lungworm in calves, trefoil dermatitis, ulcerative granuloma in pigs and pyobacillosis of swine.

CONTROL OF THE CATTLE TICK.—In view of the freedom from tick infestation enjoyed by most of the area south of the Byron Bay-Lismore railway, a line was established known as the Coraki-Byron Bay Quarantine Line, south and east of which inspections were carried out at 60-day intervals, while stock movements were permitted to take place only after inspection. In December, 1928, the line was extended to the railway line from Lismore to Casino; in April, 1929, it was extended to include the municipal boundary of Casino to the Richmond river, and the Tenterfield-Casino road to the Hogarth Range, running along that range to the quarantine boundary.

A table showing the infestations during each month of the year is given for each of the quarantine areas. 436 occurred altogether. 29 were classed as re-infestations, and the remaining 407 were fresh ones as against 211 during the previous year. As it was impossible to carry out regular inspec-



tions and treatments owing to excessive rainfall during a great part of the active tick season of 1927-28, a large number of mature ticks probably escaped and reared fresh broods. At the same time, owing probably to the drouthy period during the first half of the year under review, cattle had to cover the whole of a holding in search of food, and picked up ticks which they would not have done if the pastures had been good and they had not moved about so much. Nearly half a million more cattle were inspected during the year under report than formerly, and this may have accounted for the discovery of more infestations.

Eight of the infestations were south of the 60-day line, and the origin of the outbreaks could not be traced. Horses may possibly have carried the ticks, as interchanges of horses occurred between railway construction camps in the vicinity. Some trouble is encountered from the fact that stock owners hide the occurrence of ticks on their properties. The Cattle Tick Commission recommended in 1916 that adjoining farms should be treated at the same time as infected farms. This policy was later modified and, under certain conditions, the State Board of Tick Control is permitted to exempt farms. 292 farms were given exemptions, and 19 of them were later found to be infested.

**SWINE COMPENSATION.**—During the year the Swine Compensation Act, 1928, was passed and became operative on March 15th. The Act is designed to provide a fund for the payment of compensation in cases where pigs are slaughtered as affected with certain prescribed diseases, or carcasses are condemned at abattoirs as unfit for consumption owing to disease. The fund from which compensation is paid is collected by the affixing of special swine duty stamps (one shilling per pig) in a pig register, maintained at each pig-slaughtering establishment. 699 pigs were condemned for tuberculosis between March 15th and June 30th., in eleven districts, and £2,390 4s. 3d. was paid in compensation.

**LIVESTOCK CENSUS.**—The Statistician's figures for the state for the year ending 30th June, 1928, were :—horses, 598,377; cattle, 2,848,654; sheep, 50,510,000; and pigs, 301,819.

**GAMBIA, COLONY OF THE. (1931.) The Annual Report of the Department of Agriculture for the Year 1929-30.** London: Crown Agents for the Colonies. [5s.]

An appendix consists of a report by Mr. M. V. Earnshaw, Veterinary Officer, Nigeria, on a visit he paid to the Gambia for a fortnight in August, 1929, to see the conditions and advise regarding animal disease and steps to be taken to deal with them. Hitherto there has been no veterinary officer in this protectorate.

Apparently from the lack of expert guidance, native names were used by the British lay officials when speaking of the different diseases. One cattle disease which had been reported was found to be rinderpest. It was introduced into the Gambia many years ago and raged as a severe epizootic; it has since smouldered and flared up at intervals.

There was evidence of the existence of contagious bovine pleuropneumonia. Although no trypanosomes were found in the course of the few observations made, there was abundant evidence that trypanosomiasis is common. "Fly" belts exist in the country.

All the usual diseases of live stock of such areas appear to be represented in the various native names quoted, and in the descriptions given by the natives.

The report contains a recommendation that a veterinary department be established.

Mr. W. W. H. Henderson, the Chief Veterinary Officer, Nigeria, has written a note on this report. He supports the suggestion that a veterinary department is needed in the Gambia.

**KENYA, COLONY AND PROTECTORATE OF. (1930.) Report of the Chief Veterinary Officer for the Year ended December 31st, 1929.** [BRASSEY-EDWARDS, H. H.] Ann. Rep. Dept. Agric. Appendix C. pp. 97-173. [Printed Report; fcp.]

**STAFF.**—Lieut.-Col. Doherty was succeeded as Chief Veterinary Officer by Major H. H. Brassey-Edwards. The post of Deputy Chief Veterinary Officer was vacant. There were three senior veterinary officers and 13 veterinary officers. In addition there were 25 stock inspectors and one stock instructor.

The present veterinary districts are too large, and the staff was unable to cope with all the demands for assistance.

"Taking the colony as a whole, the diseases which demand the greater portion of the departmental energies are rinderpest, contagious bovine pleuro-pneumonia, tick-borne diseases, and, to a lesser extent, contagious abortion, trypanosomiasis, anthrax, blackquarter and plant poisoning."

**EXPENDITURE AND REVENUE.**—The total expenditure was £52,317, and £21,279 was collected from sales of biological products, dipping fees, quarantine fees, &c.

**OUTBREAKS OF DISEASE.**—The following are the numbers of outbreaks of diseases reported:—anthrax (20), tuberculosis (2), ulcerative lymphangitis (23), bovine contagious abortion (5), black-quarter (13), actinomycosis (1), epizootic lymphangitis (3), bovine lymphangitis (3), trypanosomiasis (9), East Coast Fever in clean areas (32), anaplasmosis (14), rinderpest (66), contagious bovine pleuro-pneumonia (4), foot-and-mouth disease (7), horse sickness (11), sheep pox (3), blue tongue (2), heartwater (4), rabies (1), swine fever (0), and "Laikipia lung disease" (1).

Cases of rabies in dogs, of actinomycosis and milk fever in cattle and of "pulpy kidney" in sheep were observed for the first time in Kenya.

**RINDERPEST.**—A special rinderpest service is maintained, and it was fully occupied during the year. With the exception of the Nairobi area the number of outbreaks was small. In one district compulsory inoculation was carried out at the request of a local body, and there are indications that such action will be asked for in other districts. 150,397 double inoculations and 9,173 virulent blood tests were carried out. The mortality returns showed that the losses were 1.5 per cent. in inoculated dipped stock and less than 1 per cent. in undipped and native stock. The chief cause of mortality was "redwater." The use of larger doses of serum in simultaneous inoculations has overcome the mortality from severe reactions that occurred at one time. The danger of simultaneous transmission of redwater and virus which has been responsible for high mortality in dipped stock, has been largely overcome by the use of tested virus producers, free from "redwater," supplied by the laboratory. Some difficulty is experienced in obtaining a supply of susceptible animals. An improvement in the technique of preparing the virus for inoculation into the virus producers by the use of treated virulent spleen pulp has eliminated the danger of infecting a "clean" virus producer with piroplasms as well as with rinderpest.

**USE OF RINDERPEST VACCINE.**—Experimental inoculations were carried out with two types of inactivated vaccines.

**CONTAGIOUS BOVINE PLEURO-PNEUMONIA.**—Four outbreaks occurred, all in one district. 12,677 inoculations were carried out. The disease is prevalent in the native reserves. Vaccine is issued free, and annual inoculations are advised.

**TICK-BORNE DISEASES.**—The position with regard to these diseases is said to be menacing. Cattle Cleansing and Fencing of Holdings Bills have recently been passed, and it is said that their application must check the progress of these diseases. The Cattle Cleansing Bill is not, however, in the opinion of the veterinary department, wide enough in its scope.

East Coast fever spread seriously in gazetted "clean" areas. There was a considerable increase in the incidence of "heartwater," the causal tick being spread by the trekking sheep of itinerant traders. Sheep from the Northern Frontier Districts appear to be immune. The great difficulty in eliminating "heartwater" ticks as compared with East Coast Fever ticks is discussed. "Redwater" and anaplasmosis are prevalent on most farms, and are responsible for a big annual mortality in young stock. Efficient dipping and hand-dressing prevent most of the loss.

**IMPORTATION OF CATTLE.**—Immunisation against redwater and anaplasmosis is discussed in considerable detail. Owners are often critical with regard to the expense of maintaining animals at the quarantine station because of the relatively long time required for the process. There is no alternative, however, as individual variation controls the manner in which different animals behave during the various stages of the inoculation processes. A strain of anaplasms of low pathogenicity is used at first, and, later, the animals are inoculated with a vaccine containing natural and stronger strains of the causal piroplasms and anaplasms, comparable with the strains transmitted by the ticks on the farms.

**ANTHRAX.**—Anthrax has been a scourge for many years, and only a small proportion of the outbreaks are reported and diagnosed, although it is a notifiable disease. Emphasis is laid on the value of the vaccine produced by the Kabete Veterinary Laboratory, and on the fact that insufficient use is made of it.

The position is said to be very unsatisfactory from the veterinary point of view, and it appears to be related to the state of existing regulations.



**TRYPANOSOMIASIS.**—Trypanosomiasis is not as great a scourge as in some other African countries. Experiments in treatment were carried out.

**RABIES.**—Hitherto Kenya had been free from rabies, but a case occurred during the year.

**VETERINARY SERVICES IN NATIVE RESERVES.**—Veterinary Officers were stationed in the Native reserves of Nyanza Province, Nzoia Province, Rift Valley Province, Masai Province and Ukamba Province. They dealt with the important diseases by methods suitable to the conditions, and the methods were usually different from those employed in settled areas.

**KENYA, COLONY AND PROTECTORATE OF. (1930.) Rpt. of the Chief Veterinary Research Officer.**  
[WALKER, J.] *Ann. Rep. Dept. Agric. Appendix D.* pp. 174-417. Nairobi: Govt. Printer.

In addition to a general account of the working of the department, papers on rinderpest, East Coast fever, redwater, anaplasmosis and *Gonderia mutans*, contagious bovine pleuro-pneumonia, "Nairobi quarantine disease," trypanosomiasis, heartwater, "Laikipia lung disease," "Nairobi sheep disease," abscesses in the brain of sheep, East African swine fever and poisonous plants of Kenya, are included in the report. These will be dealt with separately.

**STAFF.**—There were four veterinary research officers in addition to the Chief Veterinary Research Officer.

**FINANCIAL.**—£38,160 was expended, and there was a revenue of £18,145 from the sale of laboratory products, most of which was in respect of sales to other governments. Anti-rinderpest serum to the value of £25,077 was issued to the field staff, and the money recovered for inoculations carried out is shown in the report of that department.

**INOCULATION OF COCKS.**—492 Rhode Island Red cocks were immunised against fowl typhoid and fowl-pox before they were issued to native reserves.

**ROUTINE DIAGNOSIS.**—6,330 slides and specimens were dealt with.

**PREPARATION OF LABORATORY PRODUCTS.**—Anthrax vaccine (8,763 doses of first and 8,863 of second vaccine), liquid "blackquarter" vaccine (29,708 doses), "blue-tongue" vaccine (4,650 doses), colon bacillosis vaccine (4,950 doses), contagious abortion vaccine (413 doses), chicken-pox vaccine (1,804 doses), fowl typhoid vaccine (13,445 doses), "Laikipia lung disease" vaccine (41,054 doses), pleuro-pneumonia vaccine (53,464 doses), paratyphoid vaccine (1,601 doses), rinderpest vaccine (15,921 doses), anti-rinderpest serum (513,555 doses), sheep-pox vaccine (19,295 doses), trypanblue for bovine use (619 doses), and for canine use (181 doses), and powder for wireworm treatment (887,100 doses), were prepared during the year.

The research side of the work is dealt with in the publications mentioned above.

**NORTHERN RHODESIA. (1930.) Annual Report, Department of Animal Health for the Year 1929.**  
[SMITH, J.] 27 pp. [11 pl., fcp.] London: Crown Agents for the Colonies.

The report of the Veterinary Research Officer, which is included in that of the Director of Animal Health, is dealt with separately in this journal.

Motor lorries are now provided for the Stock Inspectors, so that, on arrival at a given centre, they can visit outlying areas on bicycles. Most of the work of the department is still confined to the more settled areas adjoining the railway line. Northern Rhodesia remains one of the "cleanest" territories in Africa so far as the more dangerous diseases of stock are concerned. Veterinary supervision is, however, almost absent from certain of the adjoining territories which are in a less fortunate position. To watch for the introduction of disease from outside, outlying cattle should be kept under observation, but that cannot at present be done. Practically all the meat supplies for the industries in the Katanga province of the Belgian Congo pass through Northern Rhodesia, either from Southern Rhodesia or N'Gamiland. During the year under report, 32,912 head passed in transit under the quarantine regulations of Northern Nigeria.

The director emphasises the need for the employment of modern methods in stock-raising. Improvement in quality by the introduction of foreign blood brings a need for better feeding, and this can only be provided by taking all the necessary steps to conserve and improve pastures and grow fodder crops. He advocates the construction of more fencing on the European-owned farms, and also of more dipping tanks.

The government is doing all it can to encourage native owners to take the necessary steps for

improving their stock, but the native-owned cattle are neglected. There is a strong demand for cattle for slaughter, but the natives take very little advantage of it, even though they have the animals.

Contagious bovine pleuro-pneumonia only exists in the Barotse province, and a strong police cordon is maintained around this province to prevent extension to "clean" areas.

For many years a cattle-free belt had been maintained on the Tanganyika border. During the year the cattle belonging to natives in this area have been allowed to return after being branded and registered, as the position regarding rinderpest is very satisfactory in the adjoining part of Tanganyika Territory.

Tuberculosis is unknown except in the Fort Jameson district. All imported cattle are tested. "Heartwater" was considered to be non-existent, but now it is known to occur. The mortality is not high and methodical dipping, reduced to a short interval during certain months, should prevent the disease from becoming the cause of much loss amongst European-owned stock. Hitherto the disease had not been diagnosed among native-owned stock.

East Coast fever has never been diagnosed in Northern Rhodesia, but it is present in neighbouring territories. *Gonderia mutans* infection does occur, and has at times caused some little perturbation amongst those responsible for veterinary control. Anaplasmosis is present everywhere.

Palliative treatment of cattle affected with trypanosomiasis by routine intravenous injection with tartar emetic has been carried out on a large scale. It is no exaggeration to say that the rapid development of some of the mines has only been possible by keeping the transport oxen alive by this means. The same applies to tobacco cultivation.

Bovine contagious abortion, white scour of calves, mange, and specific ophthalmia of cattle exist, and are important even though, individually, they are not such serious causes of loss as certain of the tropical conditions.

Horse sickness has always to be guarded against. Rabies is prevalent. Vegetable poisoning is important, and requires further study. "Veld" poisoning, a disease of unknown etiology, has been less prevalent than in former years. A disease of cattle, spoken of as "Senkobo Scab," is of considerable economic importance. It is confined to Northern Rhodesia, the Belgian Congo and the Northern portions of Southern Rhodesia. It is at present dealt with by destruction of heavily infected animals, rigid segregation of others, and by dipping. Tables, showing rainfall, cattle importation, cattle censuses and details of outbreaks of specific diseases, are included.

The European-owned stock census is:—93,961 cattle, 4,763 sheep and goats, 3,326 pigs, 423 donkeys, 19 mules and 65 horses. There are believed to be about 379,000 native owned cattle. There are 166 dipping tanks.

The report is well illustrated with photographs of the Central Research Station, Mazabuka, and of the groups photographed at the opening ceremony.

**NORTHERN RHODESIA. (1930.) Report of the Veterinary Research Officer for the year 1929.**  
[MACDONALD, R. A. S.] Ann. Rpt., Dept. of Animal Health, for the year 1929. London : Crown Agents for the Colonies.

The Central Research Station, Mazabuka, is now occupied. It is a combined agricultural and veterinary institution, but the two departments are independent. The Station was constructed during 1928 and 1929, and was officially opened on November 2nd, 1929. The accommodation and facilities comprise laboratories, stabling, paddocks, dipping tanks and dwelling houses. The laboratories are fitted with gas (Mansfield oil-gas plant), electric-light (Petter engine and battery) and water, and are well equipped.

"Senkobo Skin Disease" has been investigated, and preliminary work suggests that it is a streptothricosis. Observations were made on babesiasis, glanders, horse-sickness and vegetable poisoning, and routine diagnosis was carried out for the department.

**SOUTHERN RHODESIA. (1930.) Report of the Director of Veterinary Research for the Year 1929.**  
[BEVAN, LI. E. W.] 14 pp. Salisbury : Govt. Printer.

**STAFF.**—The technical staff consists of the Director of Veterinary Research and a research officer.



**ROUTINE WORK.**—The officers of the Veterinary Department now examine blood smears and other preparations themselves instead of submitting them to the laboratory, and this has reduced the amount of clerical and routine work previously dealt with. There is still some routine examination of specimens; vaccines are prepared, and with the ordinary clerical and general laboratory work very little time is available for research.

The water supply failed during the year. This impeded progress considerably, and the health of the laboratory animals suffered. Temporary measures for providing a water supply have not been satisfactory, but a municipal water scheme will soon be in operation, and will supply the needs of the laboratory.

**LABORATORY PRODUCTS** to the value of about £1,000, very little above the cost of production, were issued. If these products had been bought from commercial firms, the cost would have been much higher.

**BLACKLEG VACCINE.**—About 70,000 doses were issued.

"This vaccine, which is known as the 'Rhodesian quarter-evil vaccine,' from the fact that it differs from any other vaccine issued as a preventative against this disease, has proved extremely efficacious. Its cheapness, keeping qualities and simplicity of application, render it very popular, and it has to a large extent supplanted all other quarter-evil vaccines hitherto used in this country."

**REDWATER AND GALL-SICKNESS VACCINE.**—There has been little demand for this vaccine, probably because its uses are not generally understood.

**HORSE SICKNESS VACCINE.**—Horses and mules have been superseded by mechanical transport, and there has been very little demand for this vaccine. There are, however, still 2,541 horses and 1,352 mules in the country. The mortality from horse sickness in inoculated animals is a little under 3 per cent., against a former mortality of 50 per cent. A table is given of the inoculations of police horses during the last 15 years. The Southern Rhodesian vaccine was tested at the Onderstepoort laboratory with satisfactory results.

**VACCINE FOR *Brucella abortus* INFECTION.**—About 5,000 doses of the special devitalised vaccine were issued. Stock owners neglect to control the disease even though it causes them serious losses.

#### RESEARCH.

The accommodation of the laboratory, which has less than 100 acres of land, is insufficient. When there is any grazing it is overstocked, and in the dry season animals would starve if they were not supplied with other food. Observations cannot, therefore, be carried out in natural conditions on an adequate scale.

The Director considers that a travelling laboratory would be useful to deal with work on material that cannot be sent in conveniently to headquarters. He considers that some re-organisation of the department is necessary in order that the research staff may devote its whole energies to research.

**Trypanosomiasis.**—About 18,000 square miles of the country are infested by tsetse fly. The problem of the transmitted disease will probably be solved by the elimination of the fly. Experiments to this end, by removing shelter for the fly, had been planned but were not completed owing to lack of facilities. *T. pecorum* and *T. vivax* infection are discussed at considerable length.

**Sheep Diseases.**—There are 79,669 European owned and 279,678 native owned sheep. The losses are very high, and there is need for considerable study of the sheep diseases of the country.

**"Redwater" and Gall-Sickness.**—There are considerable difficulties in immunising animals against these diseases, and there is some variation in the methods adopted in different parts of Africa.

The protection of cattle against "redwater" and "gall-sickness" is tremendously important to the country; the Director has devoted a great deal of time to the subject for many years and has achieved a large measure of success.

**REVENUE.**—The total vote is £6,580.

**HONG KONG. (1930.) Report by the Colonial Veterinary Surgeon. [MACKENZIE, W. J. E.]**

The staff consisted of two veterinary officers, five lay inspectors and an overseer. Most of the report deals with duties carried out in connection with the abattoir. Apart from animals kept by the military authorities, animals kept for slaughter in Government depôts, work or store cattle, or pigs, the live stock census of the area was:—ponies, 343; asses, six; cows, 1,868; and sheep and goats, 180. Five cases of glanders, six cases of rabies, and three outbreaks of rinderpest occurred and were dealt with.

GOLD COAST. (1930.) **Annual Report of the Principal Veterinary Officer for the Year 1929-30.**  
[STEWART, J. L.] 20 pp. Accra : Govt. Printer.

STAFF. Capt. W. P. BEAL retired towards the end of the year and was succeeded by Mr. J. L. STEWART. There were five veterinary officers and one post was vacant ; a veterinary pathologist will be appointed at an early date. There were also one European livestock inspector, two permanent and two temporary African veterinary assistants, three African clerks and 62 cattle patrols.

LEGISLATION. Three amendments to the Importation of Livestock regulations and an Ordinance to make provision for the appointment of cattle guards were passed during the financial year.

VETERINARY TRAINING. There is a training centre at Tamale, at which Africans are given three years' instruction in order that they may become veterinary assistants. Ten pupils were in training. These men undertake work of an elementary nature, such as dispensing, meat inspection, inoculations, post-mortem examinations, and routine laboratory work under the direction of a veterinary officer ; they supervise small areas for the control of disease, take charge of quarantine stations, and understand the law with regard to livestock and diseases of livestock.

ORGANISATION. The headquarters of the veterinary department are at Tamale in the Northern Territories which are divided into three veterinary sections.

It was possible to open a coastal veterinary section during the year as the staff had increased. The veterinary officer in charge is stationed at Accra and deals with the stock-raising area which extends from Accra to the French Togoland frontier and from ten to fifty miles inland. There are about 40,000 head of cattle in the area and it has great stock-raising possibilities.

VETERINARY LABORATORY. A scheme for the erection of a laboratory at Pong Tamale, 20 miles north of Tamale, was held up temporarily owing to lack of funds.

QUARANTINE STATIONS. There are six quarantine stations through which cattle pass when they come into the Colony.

DISEASE. Of 21 cases of equine trypanosomiasis diagnosed, two were infections with *T. brucei* and the remainder were due to *T. vivax*. In the Gold Coast, horses are said to be more susceptible to trypanosomiasis than other animals, and infections produced by tabanids and by stomoxys appear to be less virulent than those transmitted by tsetse fly.

Zebu cattle are said to possess some resistance to the local trypanosomiasis. The clearances made at river crossings and in thick bush in the Northern Territories on the north-east cattle route from Bawku diminished the amount of infection. Native cattle are said to be highly resistant to piropalamosis.

There were no serious outbreaks of rinderpest and the disease was not prevalent in the adjacent French colonies. Inability to obtain a regular supply of anti-rinderpest serum led to the decision to build a laboratory. Arrangements are being made for the area within easy reach of Tamale to be kept free from the disease without resort to inoculation, so that virus producers may be available when required.

Seventeen cases of anthrax were diagnosed, but this is not considered to be an indication of its incidence. In seven outbreaks, 43 cattle were affected with contagious bovine pleuro-pneumonia and all were slaughtered. Tuberculosis has never been observed in domesticated animals in the Northern Territories, but a case was found in a pig at the Accra abattoir during the year. Lymphangitis is prevalent in sheep and goats. Six cases of equine epizootic lymphangitis were reported. Bovine and caprine skin streptothricosis is prevalent throughout the stock breeding areas. Fowl cholera, roup and spirochaetosis were reported.

Rabies is rare in the Colony, probably on account of the absence of jackals. An outbreak occurred at Accra.

Worm parasites are responsible for a considerable amount of disease. A list is given of certain parasites identified from horses, donkeys, cattle, goats, pigs and hens.

MEAT INSPECTION. Of the cattle slaughtered at the Tamale abattoir, 9.6 per cent. were infected with *Cysticercus bovis*, 8.5 per cent. with contagious bovine pleuro-pneumonia, 30.2 per cent. with liver flukes, 12.9 per cent. with onchocercosis, and 1.1 per cent. with echinococci.

Of the sheep and goats slaughtered, 2.9 per cent. were affected with caseous lymphadenitis, 5.8 per cent. with liver flukes, 24.4 per cent. with hepatitis, 54.7 per cent. with *Oesophagostomum columbianum* intestinal nodules, 0.3 per cent. with echinococci and 3.3 per cent. with nephritis.

ANIMAL HUSBANDRY. The operations of the department are described.



## DISEASES, GENERAL.

GILL, Dudley A. (1931.) "Circling" Disease of Sheep in New Zealand. *Vet. Jl.* '87. 60-74. [11 text figs.]

The disease occurs in the autumn from about February to June, and usually attacks hoggets though older sheep are sometimes affected. It is said to be more prevalent than usual towards the end of a spell of dry weather and that, soon after the weather breaks, the losses decline and stop. The symptoms are of short duration, but may last several days. There is dullness, the head is held in an unnatural position, and the animals move in circles until they come into contact with a fence or other obstruction when they stand pressing their foreheads against it. There is a marked tendency to somnolence. Salivation and nasal catarrh are sometimes present. The disease is probably always fatal. The presence of *Oestrus* larvæ or of *Coenurus cerebralis* was suspected by those who observed the cases, but close examination did not reveal their presence. The middle ear was normal, and the brain appeared to be normal to the naked eye.

The author describes six cases, and the results of work he carried out in connection with them. From the prevalence of microscopic purulent foci, perivascular cuffing, and the similarity of many of the symptoms to those described as occurring in cases of enzootic meningo-encephalitis in animals, he considered the possibility of the disease being caused by a filterable virus. Very few cases were available for examination and appropriate inoculations had not been carried out at the time of writing.

Cytological and bio-chemical examination of the blood and cerebro-spinal fluid of affected animals led to the belief that the disease was infective in nature.

Cultures obtained from two of the cases were examined; the growths were not all of the same type. Certain inoculations were made into experimental animals, and these are described.

The author is anxious to correspond with those who have investigated a disease of this type.

GRAHAM, Robert, THORP, Frank J. R., and JAMES, W. A. (1930.) A Note on Avian Laryngotracheitis. *Jl. Amer. Vet. Med. Ass.* 77. 587-594. [1 table.]

In a study of this disease made at the Illinois Agricultural Experiment Station, it appears that more than one clinical type of the disease may occur, and that the so-called bronchitis syndrome in fowls is really a laryngotracheitis. The course of infection may be acute, subacute or chronic: a toxæmic syndrome sometimes occurs.

The commonest organisms isolated from the laryngeal exudates of affected birds belong to the diphtheroid group, and are infective for the upper respiratory tract of healthy birds in experimental conditions. A variety of organisms isolated from clinical cases of laryngotracheitis were capable of producing a subacute attack in healthy chicks following post-glossal or intralaryngeal instillation. Intravenous inoculation caused intense œdema and congestion of the larynx and large doses often produced toxæmia and death in fowls of various ages. The work done seems to suggest that the exact etiology of the acute and subacute forms is not identical, and that a filterable virus may be involved in the acute form. The pathological changes induced by artificial infection transferred from an acute natural case, often resembled those of the natural subacute form and, when single strains of the pathogenic diphtheroid organisms were applied to the larynx, they gave rise, not to an acute attack, but to a subacute one.

The morphological and cultural characters of the diphtheroid organisms isolated are described. They showed great pleomorphism. At least three serological types were differentiated by the agglutination test, using antisera produced in horses and rabbits.

Laryngotracheitis occurs in young chicks as well as in adults, and runs a short course accompanied by a toxæmic syndrome with little tendency to the formation of local lesions. Diphtheroid organisms, similar to those obtained from adult fowls, have been recovered from naturally infected chicks.

I. GOETZE, R., and LIESS, J. (1929.) Erfolgreiche Uebertragungsversuche des bösartigen Katarrhalfiebers von Rind zu Rind. Identität mit der Südafrikanischen Snotsiekte. (Successful Experiments in the Transmission of Malignant Bovine Catarrh in Cattle. Identity with the South African "Snotsiekte.") *Deutsch. Tier. Woch.* 37. 433-437.

- II. GOETZE, R., and LIESS, J. (1930.) Untersuchungen über das bösartige Katarrhalfieber des Rindes. Schafe als Uebertrager. (**Researches on Malignant Bovine Catarrh. Sheep as Vectors.**) *Deutsch. Tier. Woch.* **38.** 194-200. [3 plates, 2 figs.]
- III. GOETZE, R. (1930.) Untersuchungen über das bösartige Katarrhalfieber des Rindes. (**Researches on Malignant Bovine Catarrh.**) *Deutsch. Tier. Woch.* **38.** 487-491. [4 plates.]

The authors made an extensive study of malignant catarrh, dealing with natural cases and carrying out experiments on large and small animals. They studied single and multiple cases on over 40 farms; the disease usually occurred sporadically and had no tendency to spread in a herd or from one farm to another; but successive cases generally occurred in animals which occupied the same standing. Hygiene, dietetics and general management appeared to have no influence on the incidence of the disease. The authors noticed that, in practically every instance, sheep had been kept in contact with the affected animals and, that the disease died out when sheep were removed, although in some instances this did not occur until three or four months after contact with the sheep had ceased.

A number of sheep in contact with clinical cases were removed to the instructional farm of the Hanover Veterinary College and placed among a number of healthy cattle [number not given] to ascertain whether sheep could act as carriers. Three months later one beast contracted typical malignant catarrh. The sheep were at once removed and the cattle shed was thoroughly disinfected, but 13 more of the cattle sickened [intervals not given] and only one survived. The sheep remained healthy throughout the experiment and there was no indication of the manner in which they infected the cattle.

Repeated bacteriological examination of the disease in cattle yielded negative results. The authors succeeded in transmitting it from the infected cattle to healthy ones by intravenous, subcutaneous and intradermal inoculation, and by administration *per os*, of whole blood and of citrated and defibrinated blood. Negative results were obtained with blood serum, filtered blood, and also with suspensions of various tissues.

They consider that the infective agent may be contained in the red blood corpuscles but that its exact nature is obscure. Attempts to infect cattle by the administration of tissues, excretions, secretions and parasites of the sheep used in the instructional farm experiment, all gave negative results.

Consideration was given to the possibility that an insect vector is concerned: living lice from an affected animal were placed on a healthy one, but it did not contract the disease. Similarly, inoculation with suspensions of the crushed bodies of external parasites, by various routes, gave negative results.

The authors recognise four clinical types of malignant catarrh:—(1) the peracute type which runs a septicæmic course with an early mortality; (2) the intestinal type which is usually fatal within nine days; (3) the head and eye type in which the illness may last for one to three weeks, this type sometimes occurring simultaneously with the intestinal type and (4) the benign type in which recovery is spontaneous and which is liable to escape diagnosis.

The symptomatology and pathology of each type is described in detail and the differential diagnosis is discussed. The authors consider that malignant catarrh is identical with the African disease "Snotziekte," and disagree with METTAM who considers them to be separate entities.

An animal which had survived one attack of the disease resisted re-infection when given repeated doses of fresh blood from clinically affected cattle, whilst control animals became affected.

The authors consider that their observation of the significance of sheep in relation to malignant catarrh has provided the key to successful control. In their experience treatment with chemo-therapeutic preparations was unsuccessful.

WOODS, A. C., and CHESNEY, A. M. (1930.) **The Transmission of Periodic Ophthalmia of Horses by Means of a Filterable Agent.** *Jl. Exp. Med.* **52.** 637-647.

WOODS and BURKY (1929) obtained uniformly negative results with aerobic and anaerobic cultures prepared from the eyes of horses affected with periodic ophthalmia, both in the active and in the quiescent stages.

The authors describe a further series of experiments in which they demonstrated the existence



of a filterable agent in the humours and tissues of eyes from affected horses. Intra-vitreous inoculation of filtrate produced typical recurrent attacks of the disease. When inoculated into rabbits a different clinical picture was produced. After passage through six generations of rabbits, the virus produced the typical disease in horses.

THORPE, Frank, jr., and GRAHAM, Robert. (1930.) **A Study of the Leucocyte Changes in the Blood of Diseased Swine.** *Jl. Amer. Vet. Med. Ass.* **77.** 198-203. [1 table.]

The authors examined the blood of 27 pigs affected with swine fever, complications being present in some cases. They found in the majority of the pigs a leucopenia with an average of 7,800 leucocytes per c.mm. In five uncomplicated cases of swine fever there was an average leucocyte count of 8,700 per c.mm. In one of these cases, however, there were 22,500 leucocytes per c.mm. In two cases of uncomplicated swine plague there was an average leucocyte count of 19,000 per c.mm.

**Report of Special Committee of the Amer. Vet. Med. Ass. on Poultry Diseases.** *Jl. Amer. Vet. Med. Ass.* **77.** 503-506.

This deals chiefly with infectious bronchitis (infections tracheitis and laryngo-tracheitis of fowls). To obtain information concerning the disease, every American experiment station and some foreign research institutes were circularised during the previous year. It has been of economic importance in the United States since 1924, or earlier, and outbreaks have occurred in eleven States, four states, and the experimental stations of the U.S. Department of Agriculture, have studied the disease. It is probably spread, as a rule, by poultry shows, egg-laying contests and similar organisations. The Committee recommends that its nature and etiology be made the subject of further investigation.

The control of bacillary white diarrhoea should be undertaken according to the recommendations made at the Third Annual Conference of Laboratory Workers in Pullorum-Disease control of 1930. General practitioners are urged to make themselves familiar with the diseases of poultry, and to be willing to undertake prophylactic and curative treatment.

**Report of Special Committee of the Amer. Vet. Med. Ass. on Prevention of Transmissible Diseases of Animals.** *Jl. Amer. Vet. Med. Ass.* **77.** 500.

ANAPLASMOSIS.—Experiments to find out whether *Tabanus sulcifrons* is of significance as a vector, have given negative results. Anaplasmosis has been found in the following states:—Arizona, Florida, Louisiana, Texas, California, Nevada, Kansas, Oklahoma and Missouri. It has been found that anaplasmosis can be transmitted from an infected to a healthy bovine by the dog-tick (*Rhipicephalus sanguineus*). Transmission can also be made mechanically by means of a lancet.

COCCIDIOIDAL GRANULOMA.—Has been found in animals only in California. The veterinary profession is urged to follow the reports of experimental work on coccidiosis in animals, especially in swine, in which species this disease has only recently been observed.

BOVINE MASTITIS.—The significance of *Streptococcus epidemicus*, the cause of septic sore throat in human beings, is alluded to in connection with the etiology of bovine mastitis.

DOURINE.—In America this is principally present in the Navajo Indian Reservation in Arizona and New Mexico, where about 2 per cent. out of 10,000 horses tested were shown to be infected. The disease exists also in other Indian Reservations, but has not been found anywhere else in the U.S.A.

TRICHINOSIS.—There was an unusual number of cases in human beings last year. In 16 cases the source of infection was traced to cured bear meat, but the remainder of the cases were due to pork. All pigs must be regarded as potential sources of the disease, and the only method of reducing the incidence of cases in human beings is education—informing people of the danger of eating raw pork, or other pig products. A skin test for the diagnosis of trichinosis in swine has been developed by BACHMAN, and is being tested extensively by the U.S. Department of Agriculture.

EULER, H. (1930.) Sterilität und Abortus mit besonderer Berücksichtigung der Verhältnisse in der Greuzmark Posen-Westpreussen und der östlichen Neumark. [**Sterility and Abortion with special reference to Conditions on the Borders of Posen and Western Prussia, and of Eastern Neumark.**] *Berl. Tier. Woch.* **46.** 853-859. [28 refs.].

It has been very generally held that sterility and abortion present two separate problems for solution. The view has been that abortion is due to specific infection and sterility to non-specific secondary infections of the uterus. The connection between the two has been explained on the ground that the primary *abortus* infection leaves the uterus in a condition which favours the development of secondary non-specific infections.

The author is inclined to think that, while not denying the importance of bacteria as the direct causes of infection, there are certain favourable predisposing conditions. He holds that these are very similar as regards abortion and sterility, and that in the future there will be a greater tendency to bring the two conditions together again in so far as their control is concerned. He refers at some length to Williams' views regarding the causation of abortion.

According to the author incorrect feeding is an important factor in the causation of sterility—the so-called "hunger sterility." The grazing grounds in the area under discussion are very inferior. Numerous quotations from literature are given to show that mineral insufficiency in the diet and lack of vitamins, are responsible for defective functioning of the genital organs. The author quotes a number of writers regarding the control of contagious abortion but adds nothing to our knowledge.

KOHN, Joseph. (1930.) Pathologie und Therapie der Sterilität und des seuchenhaften Abortus unter Berücksichtigung der Endokrinologie und der Chemo-therapeutischen Behandlungsmöglichkeiten. [**Pathology and Treatment of Sterility and Infectious Abortion with Reference to Endocrinology, and the Possibilities of Chemotherapy.**] *Berl. Tier. Woch.* **46.** 416-417.

The author discusses the principles on which sterility and abortion in cattle should be treated. He emphasises the importance of calcium and of the proper functioning of the endocrine organs in relation to ability to produce healthy offspring.

METTAM, R. W. M. (1930.) **Laikipia Lung Disease.** *Ann. Rpt., Dept. Agric., Kenya.* 333-363. Nairobi: Govt. Printer. [8vo.]

"Laikipia lung disease" which is also known as "Ngobit," "Nanyuki," and "Rumuruti lung disease," is a pleuro-pneumonia of sheep and lambs.

The disease has a wide distribution in the Colony, and the author does not doubt that, in the course of time, its distribution will become still wider, owing to movements of flocks in search of grazing and to indiscriminate purchases for stocking farms in freshly exploited districts. Up to the present the condition has not been observed at altitudes below 5,000-ft.; it is known to occur widely in Uganda, the Belgian Congo, Tanganyika, and Nyasaland, but it is unknown south of the Limpopo.

It would seem that, although the disease resembles conditions described by SEDDON in Australia and DESCAZEUX in Chile, the causal organism is quite distinct.

"Laikipia lung disease" runs an acute course in lambs and yearlings, and is generally chronic in adults. Chronic cases may relapse under adverse conditions. When recovery takes place in the peracute cases, the process is complete in a small percentage of them. On the other hand, chronic infection may persist as in the case of bovine pleuro-pneumonia. Such animals are sources of great danger.

Goats may become infected naturally, and serious losses may result. Cattle can be infected experimentally, but they do not contract the disease naturally. It is not known how infection takes place, but direct contact appears to be necessary for transmission.

The causal organism occurs in large numbers in the exudate from the lungs. The milk of infected ewes has not been found to contain it. The organism appears to be of rather low virulence, and it is suggested that predisposing factors are necessary to enable it to gain a footing. Vitamin A deficiency, hookworm infection, and dust are instanced in this connection. No exact information can be given



as to the period of incubation, but symptoms have been recorded as occurring in lambs a week to ten days old.

Direct introduction of the specific organism into the lungs produces very acute symptoms within twelve hours but, by other paths of inoculation, the period of incubation averages about 17 days. The symptoms of the acute form are those ordinarily associated with acute pneumonia, and it runs its course in from two days to a fortnight. The longer the course the greater is the chance of recovery.

Certain complications may develop: acute arthritis, necrotic lesions of the mouth, and acute ophthalmia. Chronic cases may, it is said, escape detection for years. It is not known whether the chronic form is always preceded by an acute attack or not. The symptoms of the chronic form are very vague and variable. Chronic arthritis is one of the complications of the condition.

The organism which the author incriminates as the cause of the disease is a pleomorphic Gram-negative cocco-bacillus. It was recovered from the lungs of every acute case examined, but was seldom obtained in a state of purity.

Details are given of the cultural characters on a number of media, from which the following may be selected. In broth there is uniform turbidity with the formation of a bluish-grey surface pellicle. On agar, growth is raised above the surface, and has an iridescent appearance. Gelatin is not liquefied. It was found that after a lag at the start, growth took place as rapidly at 20° C. as at 37° C.

Fermentation tests with a number of sugars showed that fermentation of dextrose, saccharose, mannite and sorbite was practically constant. No gas was produced.

Frequent subcultivation is required to keep strains alive.

The organism is pathogenic for the guinea-pig, rabbit, goat, sheep and cattle. Pigeons are very resistant.

METTAM, R. W. M. (1930.) **Nairobi Quarantine Disease.** *Ann. Rpt., Dept. Agric., Kenya.* pp. 243-293. Nairobi: Govt. Printer. [8vo.]

Serious losses occurred during the early part of 1929 among imported animals at the Nairobi quarantine station, where immunisation against redwater, anaplasmosis, &c., is carried out before the animals are sent to the owners. The process of immunisation against these diseases requires a stay at the station of at least 100 days.

The first indication of the existence of any disease was the appearance of subcutaneous and submucous hæmorrhages. These measured up to 1 cm. in diameter, but later were much larger. The hæmorrhages were followed by a rough nodular appearance of the skin lying over them, caused by swelling of the hair follicles. This was followed by the exudation of a straw-coloured liquid which dried and formed a scurfy deposit. Epistaxis was invariably observed, and was in some cases severe. The affected animals showed all the general symptoms of acute malaise. Respiration was greatly accelerated, and apparently accompanied by pain. Obstinate constipation for the first few days was followed by more or less pronounced dysentery. In a few cases, long sections of mucous membrane from the bowel were passed *per rectum*. A very remarkable feature of the disease was delayed coagulation of the blood. It is probable that the condition was associated with a mild febrile reaction, but the possibility that the temperatures recorded were due to the vaccination cannot be excluded with certainty.

In untreated cases the mortality was 100 per cent., and the illness lasted for from four to eleven days. Adrenalin was found to be extremely effective for the treatment of the condition, and after it was first used, no further fatal cases occurred.

At *post-mortem* examination the carcasses gave off an "uræmic" odour, and *rigor mortis* appeared very rapidly and was very pronounced.

Gelatinous œdema, which was sometimes mixed with blood, was found subcutaneously and frequently between the muscles. Hæmorrhages were found in the mucous membrane of the alimentary tract, and in one case there was ulceration of the abomasum.

Hæmorrhages of various sizes were present in the peritoneum, and the peritoneal cavity in some cases contained a large amount (up to a litre) of blood-stained fluid.

The spleen pulp was dryish and of a red brown colour. The malpighian bodies were prominent,



and there were subcapsular hæmorrhages. The liver showed no important changes as a rule. The lungs and pleura were generally normal. Hæmorrhages under the epicardium and endocardium gave the heart a typically blotched appearance.

No opinion can be expressed as to the morphology of the blood, as the animals were undergoing vaccination against redwater and anaplasmosis at the time. Histological examination of the organs showed that in general the changes found were attributable to blood stasis. The etiology of the condition has not been cleared up.

Adrenalin hydrochloride was found to be a specific treatment for the disease. Two or three subcutaneous or intravenous injections daily are advised. It is not quite clear what dose was given, as the text says 31 of 1 : 1,000 solution. Possibly this is a misprint for 1 drachm. Treatment of the skin lesions proved very troublesome as extensive bald patches covered with epithelial debris occurred, and at least three months elapsed before the hair grew again.

SIDOROV, N. V. (1930.) K voprosu o kormovom otravlenii loshadey prinimayushchyemysya za raznovidnost bornasskoy boleyzny. [**On the Question of Food-Poisoning of Horses regarded formerly as one of the Forms of Borna Disease.**]—*Trudy Gossoudarst. Inst. Exp. Vet. Moscow*. 6. Part 4. 37-47. [18 figures, 3 coloured plates.] [German Summary.]

Mainly an account of the pathological-anatomical changes found in the organs of horses affected with a disease in which the syndrome was comparable to Borna disease, dysfunction of the central nervous system being a notable feature. During a period of three years, the author examined the brains of 40 horses received from various districts of the U.S.S.R. and carried out detailed *post-mortem* examinations on three horses in which he had observed the course of illness. The characteristic changes of Borna infection were present only in material from one case and the paper deals exclusively with the remaining cases.

The disease tends to become enzootic in some localities and its incidence is markedly seasonal. Cases begin to occur in the Southern and Central regions of the U.S.S.R. during the summer, the peak being reached in September and October. It dies out as soon as the horses are put into winter quarters.

Chromatolysis, chromatorrhesis, karyorrhesis, pyknosis, neuronophagia and absence of Nissl's bodies, were present in the nerve cells of the brain and spinal cord; photomicrographs of section showing these lesions are given. There were no eosinophil cell inclusions such as are found in Borna disease. Cirrhosis and fatty degeneration of the liver were usually present.

Attempts to demonstrate the Borna virus yielded negative results and no specific micro-organisms could be isolated from the tissues. The author considers the disease to be a form of Schweinsberg disease.



## A PRELIMINARY NOTE ON CHRONIC HÆMATURIA (*HÆMATURIA VESICALIS*) IN CATTLE.

This disease occurs in adult cattle and is characterised by redwater due to the presence of actual red blood cells in the urine; it runs a chronic course, lasting from several months to many years, and ends in the death of the animal. It has been reported in the eastern-central parts of France, in the Elbe region and in the Black Forest of Germany, in Austria, in Bulgaria, and on the Pacific seaboard of Canada and the United States of America; and it is also known in Australia (New South Wales and Victoria). Several theories have been advanced to account for the causation of the disease. They include:—(1) the toxic effects of various plants, including members of the order *Ranunculaceæ*, sedges, rushes and hellebore; (2) the poor quality of fodder, such as a diet of coarse grasses like quaking grass and pasture grass occurring at high altitudes in wooded regions; some authors attribute the cause to lack of albumen in the food and to the excessive use of roots; (3) the presence of parasites, including coccidia, fluke worms and certain nematodes; (4) mechanical causes, such as excessive pressure on the bladder by a very full rumen with subsequent inflammation and increased susceptibility to irritants possibly present in the urine; (5) it is known that oxalic acid can cause hæmaturia; this is produced either by chemical action or by the mechanical irritation of its crystals; (6) various bacteria have been isolated from clinical cases; it is considered, however, that they have not much, if any, significance.

In Germany the disease is described as occurring typically in stall-confined cattle during, or after, a dry summer and in cattle turned out on to high-lying wooded pastures. In Bulgaria it is a disease of high lying land, from 2,500 to 7,000 ft. above sea level, and it sometimes occurs with an incidence of up to 80 or 90 per cent. of cattle in a single community. In France, on the other hand, hæmaturia occurs in low-lying districts, and is often observed during the winter as well as at other seasons.

Affected cattle pass blood-stained urine and suffer from urinary colic. As the disease progresses, a state of anæmia develops which may be accompanied by slight fever and diarrhœa, and the animal dies in a state of cachexia. Diagnosis is fairly easy owing to the presence of the characteristic hæmaturia; blood corpuscles and albumen are found in the urine. Blood examination shows a reduction in the number of red blood corpuscles corresponding to the stage of the disease; rectal examination may reveal thickening of the bladder wall, and blood clots may be palpable. Cystitis due to a specific infective origin can be differentiated by bacteriological and other appropriate methods.

Except in old standing cases the pathological changes are confined to the bladder. In the first stage, before clinical symptoms appear, the bladder wall is congested, and there is a great increase in the size and number of the blood vessels in the mucous membrane and submucous coat; superficial capillaries rupture and blood enters the lumen of the bladder, some passing out with the urine, and clots which are too large to pass through the urethra are retained. The mucous membrane becomes ulcerated and each ulcer heals by granulation. In old standing cases these granulations are very exuberant, and may reach a considerable size as polypoid or sessile growths. In the bladder of an affected animal there are lesions in various stages of development, and the continuance of hæmaturia is due to the more recent ones. Ultimately the bladder wall may reach a thickness of 2 cm., and lose its capacity for contracting. If the orifices of the ureters are involved in a lesion, the resulting stenosis leads to ureteritis and hydronephrosis. In old standing cases the whole body shows signs of anæmia, and the muscles and other tissues become infiltrated and œdematous.

Prognosis is unfavourable, and curative treatment is of no avail.

### BIBLIOGRAPHY.

- ANDERSEN, J. A. (1918.) Malignant Hæmaturia of Cattle. *Maandeskr. f. Dyr.*, **30**, 580.  
 ANDERSON. (1842.) A Singular Disease in a Cow. *Veterinarian*, **15**, 27-30.  
 ANGELOFF, ST. (1910.) Ueber ein im Rhodopigebirge (Bulgarian) vorkommendes Blutharnen des Rindes (*Hæmaturia vesicalis bovis rodopensis*). *Arch. f. Wiss. u. Prakt. Tierhik.*, **36** (supplement), 670-675.  
 ARNOLD. (1870.) Das Stallrot und seine Bedeutung. *Lydtins tierärztliche Mitteilungen*.  
 CARLENS. (1923.) Hämoglobinuri hos nötkreatur. *Svensk. Vet. Tidskr.*, **28**, 199-203. Abst., Berlin. *Tier. Woch.*, **40**, 163.



- CLEEMANN, J. H. (1918.) On Hæmaturia of Cattle of the Autumn Season of 1918. *Maandskr. f. Dyrl.*, **30**, 548.
- CLEEMANN, J. H. (1923.) Til Spørgsmaalet om Hæmoglobinurien hos malkekvæget. *Svensk. Vet. Tidskr.*, **28**, 76-78. Abst., *Berl. Tier. Woch.*, **40**, 163.
- DELCROIX. (1905.) De l'influence de l'état de gestation sur l'apparition de l'hématuria chronique de bovidés. *Ann. de Méd. vét.*, **54**, 244-5.
- FLEMING, R. H., FOWLER, F. L., and CLARK, R. H. (1930.) Hæmaturia vesicalis. *Canad. J. Res.*, **3**, 125-129.
- GALTIER and CONDEAU. (1886.) Ueber Blutharnen des Rindes. *Rec. Bull.*
- GLOECKNER, E., and HAUPT, H. (1922.) Beitrag zum Stallrot des Rindes. *Munch. Tier. Woch.*, **73**, 161. Abst., *Jahresb. Vet. Med.*, **41-42**, 215.
- GMELIN. (1897.) Ueber Stallrot. *Deutsch. Tier. Woch.*, **5**, 212.
- GOETZ, H. (1906.) Beitrag zur Pathologie der Cystitis verrucosa des Rindes. *Schweiz. Arch. f. Tierhkl.*, **48**, 1-31. [7 plates, 45 refs.]
- GRAUER, F. W. (1930.) *Hæmaturia vesicalis*. Thesis, Univ. Brit. Columbia. Sept.
- HADWEN, S. (1913.) Report of the Veterinary Director-General, Canada. p. 74. Ottawa, F. A. Acland.
- HINK. Ueber Stall- und Weidrot des Rindviehs. *Lydtins tierärztliche Mitteilungen*, **22**, 183.
- HUBNER. (1842.) Ueber Blutharnen beim Rind. *Rec. de Méd. vét.*, **19**, 173.
- KALKINS, J. W. (1924.) Bulletin Western Wash. Exp. Stn., **12**, 3.
- LAHAYE, J., and RULOT. (1926.) Contribution de l'étude de l'hématurie chronique des bovidés. *Ann. de Méd. vét.*, **71**, 192-207.
- LIENAU. (1905.) De la pathogénie et de l'étiologie de l'hématurie chronique des bovidés. *Ann. de Méd. vét.*, **54**, 185-198.
- McKEE, C. S. (1928.) *Bull. Manitoba Med. Ass.*, **5**, No. 3.
- MICKDAHL, L. H. (1918.) On the Treatment of Hæmaturia of Cattle. *Maandskr. f. Dyrl.*, **30**, 582.
- MOUSSU. (1911.) *Traité des Maladies du Betail*. 3rd Edition. Paris, Asselin et Horzeau.
- PFLUG. (1876.) *Die Krankheiten der uropoetischen systems der Haustiere*. Wien.
- RACONNAT. (1847.) Hæmaturie. *Jl. Méd. vét. Ecole de Lyon*. Vol. 3.
- REISINGER. (1924.) Das Vorkommen von Stallrot der Rinder in Oesterreich. *Wein. Tier. Monatschr.*, **11**, 39.
- ROGER. (1916.) l'oxalémie des animaux domestiques. *Bull. Soc. Centr. Méd. vét.*, **34**, 468-478.
- SCHLEGEL. (1921.) *Hæmaturia vesicalis*, Stallrot beim Rind. *Zeitschr. f. Infekt.*, **21**, 204-5.
- STOCKFLETH. (1889.) *Handbuch der tierärztlichen Chirurgie*. 2 teil. No. 4. Leipzig.
- VAES. (1843.) Harnblasenruptur beim Ochsen. *Jl. vét. de Belge*. p. 182.
- ZETTLER, J. (1927.) Zur Ätiologie und Therapie des Stallrots (*Hæmaturia vesicalis*) der Rinder. *Mitteil. V. Vereins badischer Tier.*, **27**, 85-88 and 94-96. Abst., *Jahresb. Vet. Med.*, **47**, 361.

*It has not yet been possible to verify all these references.*

An enquiry has been received concerning chronic hæmaturia in cattle, and this brief note has been prepared from a preliminary search of the literature which has been made. The condition is understood to occur in the United Kingdom, and exists probably in many places, although actual accounts of its incidence appear to be rather scanty. The bureau will be very glad to receive information regarding the disease and, particularly, in connection with investigations which have been made into its etiology.

## THE HÆMATOLOGY OF SPECIFIC ANÆMIA IN DOMESTIC ANIMALS, PARTICULARLY IN SHEEP.

A request for information on the cytology of the blood of sheep affected with distomatosis, parasitic gastro-enteritis and anæmia due to malnutrition has been received from a correspondent.

The bureau is collecting details on the subject and will welcome information both as to references of published work and to work in progress. It will also be very glad to receive reprints of publications dealing with the question.